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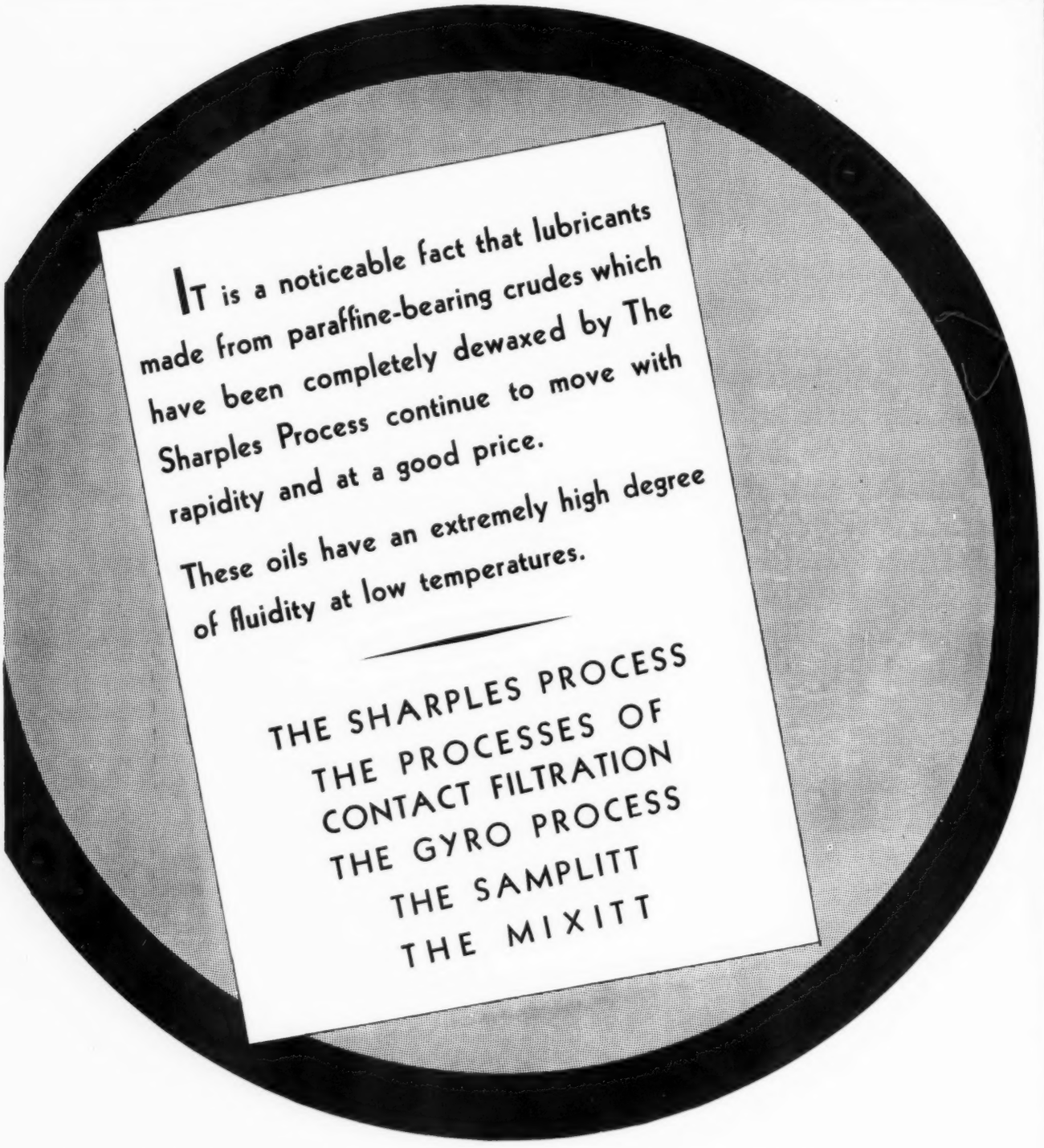
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Petroleum Engineer

The Engineering Magazine of the Oil and Gas Industry

Volume 1 JULY, 1930 Number 11

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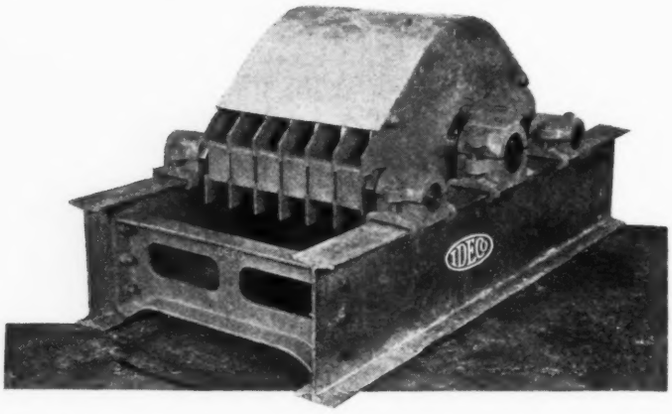


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# HEAVY DUTY AMERICAN ROLLER BEARINGS

# THE MONTH'S HIGH LIGHTS IN OILDOM

*By* J. L. DWYER

THE most interesting events of the past month in the petroleum industry were the curtailment of refinery runs and pursuant action of the Prairie Oil & Gas Co. in reducing commitments from oil producers' leases. The action of the refiners was closely followed by the announcement of the Prairie interests which was effective July first. A general reduction of fifteen per cent in the daily amount of crude oil run to stills was announced by the principal refining interests of the nation.

One salutary effect of the reduction of refinery runs was that the nation's gasoline market was noticeably strengthened. While this particular point in our industrial structure was woefully weak one month ago, it has recently displayed some strength. The seasonal condition, of course, played some part in the establishment of this situation, but it was noticeable immediately after the reduction of refinery runs.

In the increasingly important field of Hobbs, Lea County, New Mexico, the operators are struggling with the numerous difficulties of proration. A tentative market of 35,000 barrels of oil daily has been established by the three pipe line systems serving the field.

Threatened collapse of the voluntary proration plan used in the Darst Creek field of Texas since the first of the year, has resulted in the attempt of the Texas Railroad Commission's Oil and Gas Division to make use of the recently enacted pipe line and crude oil purchaser law for the first time by ordering the producers in that area to abide by their existing plan of restricting production until some substitute can be established.

After a series of meetings, it was decided to continue the present permitted daily production of the various Oklahoma fields at the rate of 650,000 barrels daily during the third quarter of the current year, and this figure has been adopted for the entire state.

Although the producing and refining situation within the industry may be lagging, the pipe line and natural gas phases are extremely active. At this time there are about three hundred million dollars worth of activities under construction in both the oil pipe and gas pipe line branches.

One of the most interesting rumors is that the Barnsdall Oil Corp. has joined forces with the Continental Oil Co. in the construction of a gasoline line to run from the Mid-Continent field to the Great Lakes territory. Originally this project was a Barnsdall undertaking. The Continental Co. is now reported to have become actively interested in this project, and plans for construction are under way.

The Phillips Petroleum Co. is also reported to have started activities for the building of its gasoline line from Oklahoma to the Great Lakes region. The pipe is reported ordered, and right-of-way taken.

Immediately after letting the contract for the ditching, stringing and laying of the line, the work on the Ajax (Standard Oil Co., N. J.) pipe line was started at the southern end. This oil line will be composed of two ten-inch lines which will be laid simultaneously. It is possible that in the distant future one of these lines will be utilized for the transportation of gasoline.

## Production and Refining Figures Furnished by the American Petroleum Institute

**Crude Runs to Stills, Gasoline and Gas and Fuel Oil Stocks, Week Ending June 28, 1930**

(Figures in Barrels of 42 Gallons)

| DISTRICT | Per Cent Potential Capacity Reporting | Crude Runs to Stills | Per Cent Operated of Total Capacity Reporting | Gasoline Stocks | Gas and Fuel Oil Stocks |
|---|---|---|---|---|---|
| East Coast | 100.0 | 3,482 000 | 81.6 | 8,163,000 | 9,208,000 |
| Appalachian | 91.0 | 546,000 | 66.9 | 1.638,000 | 882.000 |
| Ind., Ill., Ky. | 99.6 | 2,245,000 | 84.2 | 8,067,000 | 4,190,000 |
| Okla., Kan., Mo. | 89.9 | 2,067,000 | 71.0 | 4,609,000 | 4,715,000 |
| Texas | 90.4 | 4,255,000 | 85.3 | 6,802,000 | 10,444,000 |
| Louisiana-Arkansas | 96.8 | 1,190,000 | 64.9 | 2,467,000 | 1,929,000 |
| Rocky Mountain | 93.6 | 460.000 | 47.2 | 2,704,000 | 1,196,000 |
| California | 99.3 | 4,147.000 | 66.5 | 15,250,000 | 106 873,000 |
| Total Wk. June 28 | 95.7 | 18,392,000 | 74.5 | 49,700,000 | 139,437,000 |
| Total Wk. June 21 | 95.7 | 18,348,000 | 74.4 | *50,113,000 | *138,762,000 |
| The Texas and Louisiana Gulf Coastal figures shown below are included above in the totals of their respective districts. | | | | | |
| Texas Gulf Coast | 100.0 | 3,168,000 | 86.0 | 5,606,000 | 7,466,000 |
| Louisiana Gulf Cst. | 100.0 | 804,000 | 77.9 | 2,066,000 | 1,135,000 |

**Daily Average Production**

(Figures in Barrels)

| | June 28, 1930 | June 7, 1930 | June 29, 1929 |
|---|---|---|---|
| Oklahoma | 666,950 | 667,600 | 698,400 |
| Kansas | 134,200 | 134,600 | 121,900 |
| Panhandle Texas | 108,000 | 111,100 | 86,550 |
| North Texas | 81,800 | 81,400 | 83,850 |
| West Central Texas | 61,000 | 58,450 | 51.900 |
| West Texas | 307,350 | 302,100 | 369,100 |
| East Central Texas | 40,100 | 40,750 | 18,300 |
| Southwest Texas | 78,100 | 69,700 | 79,800 |
| North Louisiana | 40,200 | 40.750 | 35,400 |
| Arkansas | 57,300 | 56,400 | 69,550 |
| Coastal Texas | 187,000 | 184,000 | 130,300 |
| Coastal Louisiana | 25,900 | 23,050 | 18,950 |
| Eastern (not including Mich.) | 126,000 | 125,500 | 98 650 |
| Michigan | 10,100 | 10,300 | 18,700 |
| Wyoming | 48,800 | 49,550 | 52,900 |
| Montana | 9,450 | 9,200 | 11,550 |
| Colorado | 4,850 | 4.350 | 7,550 |
| New Mexico | 26,550 | 19,850 | 1,550 |
| California | 597,300 | 599,400 | 860,500 |
| Total | 2,610,950 | 2,588,050 | 2,815,400 |

# Unique Construction Methods

THE soft, shifty, frequently-washed, sandy formation covering the lowlands of the Canadian River area, in the north end of the Oklahoma City field, has given operators in the region something to think about. As a result several unique construction features have been adopted to combat the general conditions of the sector.

The usual rig in this district is elevated considerably higher than the floor level of the usual derrick. This is to allow for the raise of the river without danger of flooding the derrick floor. A number of the wells are connected to the roadways by wooden trestles, or dirt dikes used as roadways. It is impossible for trucks to reach the rigs without some special roadways. The raised derrick floor and wooden trestle approach is illustrated in one of the accompanying pictures.

One derrick in this portion of the field is completely surrounded by a dike to prevent flooding. Others are partially surrounded.

It is necessary to dig quite deeply in most parts of the river-bottom area to reach solid ground for the resting of the corner foundations of the rig. Something entirely new used for this is a clamshell bucket, operated by a small gasoline motor. The formation has such soft texture that the clamshell easily scoops the sand out, preparatory to pouring the cement. A small portable derrick is employed as a crane to permit the hoisting of the clamshell. Sometimes this clamshell digs to a depth of 30 feet. The derrick foundations have 36-inch diameters and 36-inch casing is used in connection with the clamshell bucket. Because of the depth, some of the wells in this area have required

**Top—Pile-driving machine working on Anderson-Prichard's Roosevelt No. 5 location. Lower left—Unique tank battery foundation being constructed. Lower right—Tractors and scrapers being used to dig a cellar.**

# Employed *in* River Bed Field

twice the average amount of cement used in construction of rig foundations.

Portable pile-driving machines have been doing quite a business since the start of competitive activity in the river-bed sector. Unusually long piles are driven to solid formation by the pile-driving machines. Some of the poles used as piling can be seen in the foreground of the picture showing the pile-driving machine.

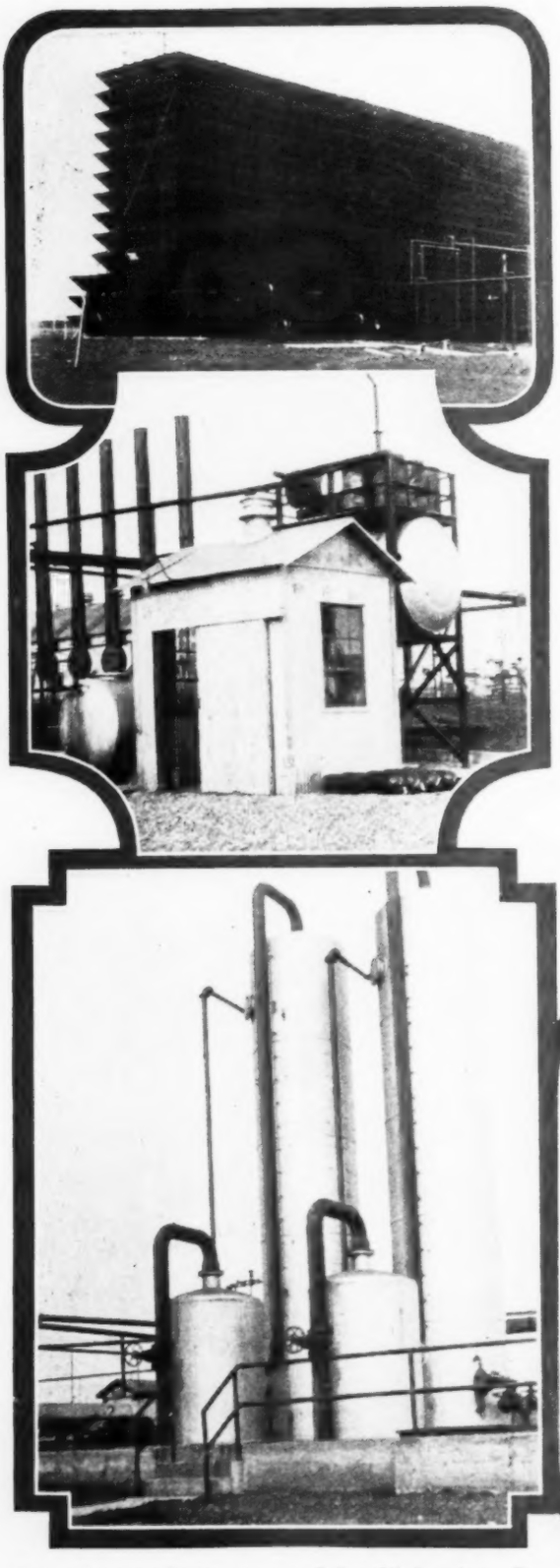
Although a number of the wells in the river area are raised to such a point that it is not necessary to dig cellars, those which require cellars find it easily and quickly accomplished by using tractors with scrapers. Two or three of these big tractors with scrapers can dig a cellar or a slush pond in a very short time. It is very seldom necessary to use a plow to soften the ground.

The soft, cavey conditions of the soil in the area have proven detrimental to several slush ponds. Most operators in the region now board up the sides of the slush pond to prevent caving. Very heavy, hard wood is used for this purpose, with piling driven as support. In this method of construction the three slush ponds are dug out as one big one and then boarded off into sections.

Even the setting of tank batteries demands special construction for the foundation. In one of the accompanying pictures the tank foundation was made by driving piling and boarding up a height of several feet. Across the top, heavy cables have been stretched for the support of the tanks. The entire enclosure is being filled with soil and leveled off before setting the tanks.

**Top—A clamshell digger at work on a rig foundation. Lower right—Slush pond box in the river-bed area. Lower left—River-bed location in the Oklahoma City field, showing raised derrick floor and wooden trestle approach.**

# Natural Gasoline Plant Work *in*

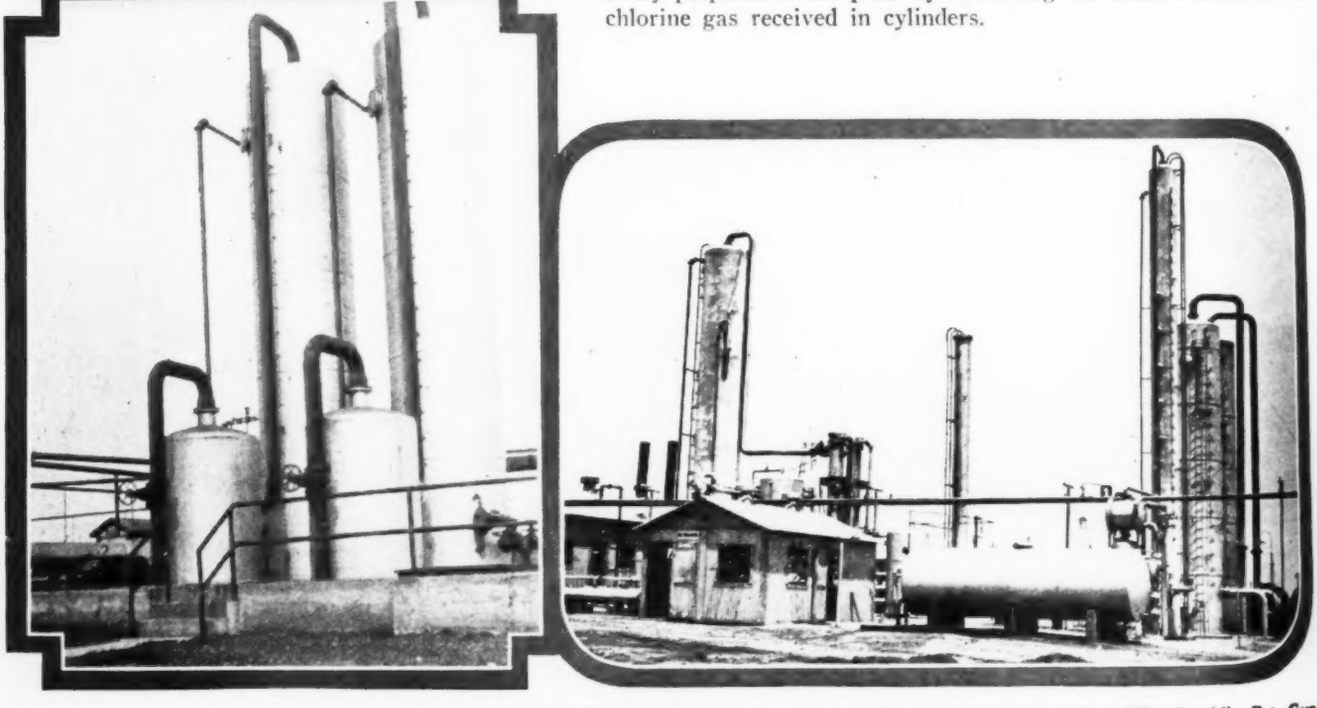


THE first natural gasoline plant in the Oklahoma City field started operating early in March, 1929. It was built by the I. T. I. O. Company, and processed gas from the discovery well. It is known as the Bodine Plant. At the present time this company has three plants in operation, the Bodine, the Button and the Verne; and two plants under construction, the Jones and the Lemon plants. The I. T. I. O. Company and the Cromwell-Franklin Company own jointly two plants, the Farley and the Trosper Park plants. The Phillips Petroleum Company has one plant in operation and one under construction. The Coline Oil Company, the Sinclair Oil and Gas Company, and the Wirt Franklin Petroleum Corporation each operate a plant.

The capacities of the plants vary from 25,000,000 to 100,000,000 cubic feet per day. The most modern type of equipment has been installed in those plants and in most cases automatic control instruments and devices are used to insure the most efficient and economical plant operation. However, at the present time, due to proration and curtailment of production efficient operation is difficult on account of the great fluctuations in the quantities of gas put through the plants at various times.

The gasoline content of the gas ranges from 0.2 to 1.5 gallons per thousand cubic feet, the average being under one gallon. At the present time most of the stripped gas is blown off into the atmosphere, only a limited quantity being sold or used as fuel in the plants, or for firing field boilers. Most of the plants are equipped with compressors, some of which are capable of compressing the gas to 1,000 pounds for recycling or the gas lift at a future date.

The natural gasoline made in the Oklahoma City field is slightly sour and must be sweetened to pass the doctor and corrosion tests. In most treating plants sodium or calcium hypochlorite is used for treating the product. A continuous closed type treating plant is usually used, and very little contact is required as the gasoline is very easily sweetened. The hypochlorite solution is most generally prepared at the plant by saturating the caustic solution with chlorine gas received in cylinders.



Top to bottom—Cooling tower at Coline Oil Co. plant. Part of the I. T. I. O. Button plant. Absorbers and surge tanks. Wirt Franklin Pet. Corp. plant.

# the Oklahoma City Field

*By*
F. R. STALEY

The low pressure type of absorber is generally used operating under pressures from 30 to 50 pounds. Mineral seal or special light absorption oil is used.

Most of the plants are equipped with stabilizing units to make grade AA natural gasoline whenever desired. The working pressure on these units averages about 200 pounds per square inch.

The most modern type of automatic control instruments and regulators are used in the plants in this field. Both temperature and pressure recording controllers are used on the distillation units and stabilizers. Liquid level controllers are also extensively used. One plant has an eight-point temperature recording instrument installed in the laboratory giving a continuous record of the various temperatures of both the lean and rich oil systems.

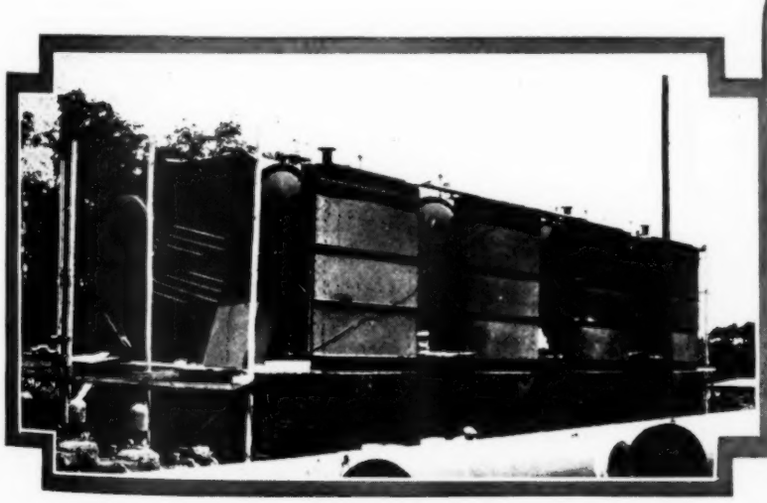
At the Button plant the company operates both an absorption gasoline plant and a topping unit for distilling the light fractions from very light crude oil, reducing it to pipe line gravity. The raw crude to this unit, containing considerable drip gasoline, is reduced from an average of 55 A. P. I. to 39 A. P. I. gravity, taking about 30 per cent overhead. This product has about 350 end point and a 66 A. P. I. gravity.

The unit has a capacity of 10,000 barrels of crude oil per day. The charge passes through a heat exchanger against the topped crude from the bottom of the towers, and then passes through a steam heater from which it enters the fractionator on the tenth tray at a temperature of 360 degrees F. The overhead vapors are condensed in the cooling coils located in the cooling tower. The topped crude from the heat exchanger is further cooled with water in the coils also located in the cooling tower. The gasoline from this unit is treated with sodium hypochlorite.

This type of evaporation or distillation unit has the advantages of low steam consumption, smooth operation, and the operation is easily controlled at low labor costs.

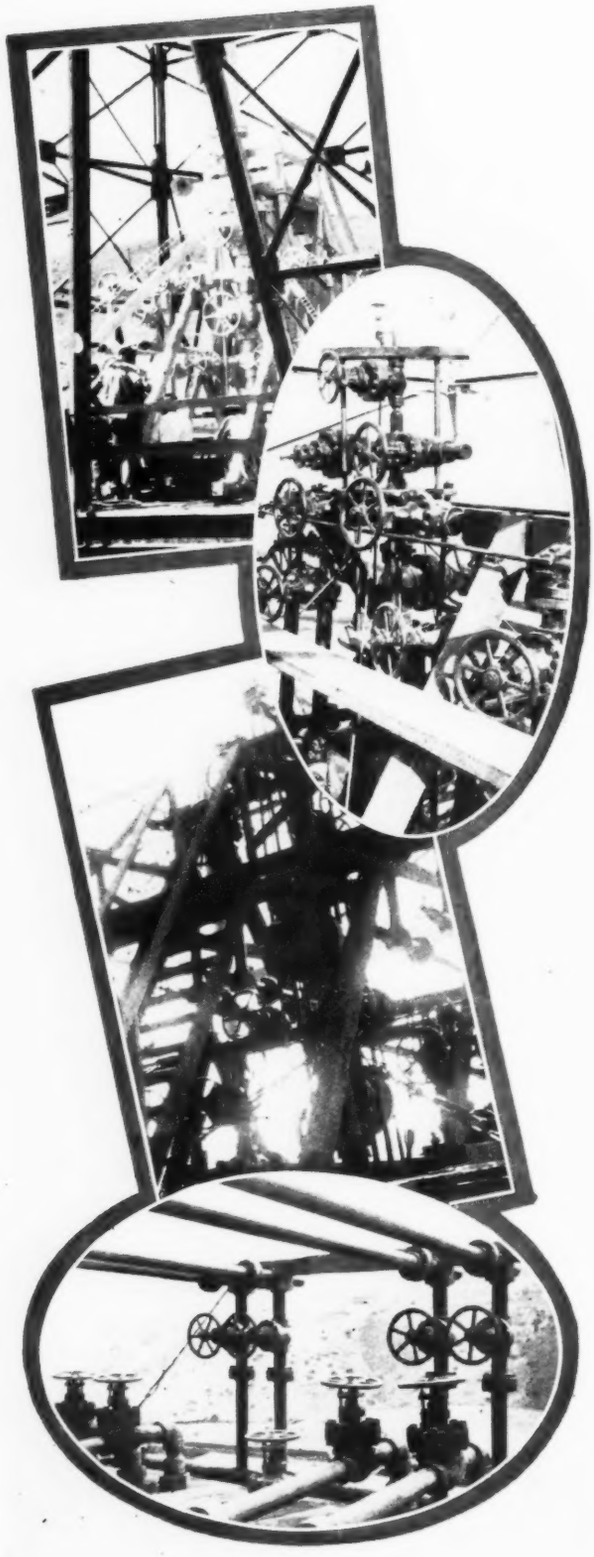
All of the gasoline produced in the Button plant both from the topping unit and the absorption plant is stabilized at the Bodine plant.

In order to keep a close check on the plant operations and the finished products, chemical laboratories and plant chemists are located at most all of the plants, and the most up-to-date chemical and physical testing apparatus has been used to equip these departments. In addition to the regular routine tests, some of the laboratories are carrying on research programs.



Top to bottom—Topping unit. Stabilizer. Close-up of the Button plant topping unit. Left—Boiler house under construction.

# How a "Wild" Well at Kettleman



***Nine Months Continuous Operation Without Trouble Points to Thoroughness of Method Used***

KETTLEMAN HILLS field, California, already acclaimed as a wonder field on account of its vast size, the prolific nature of its oil and gas resources, the high gravity (60-61 degrees A. P. I.) of the oil and the richness of the gas, is destined to tax all the skill and ingenuity that the industry can command. This was demonstrated when the Continental Oil Co.'s well, Elliott 12-8, in the Kettleman Hills field, after having been completed and brought in under perfect control, blew out at a point below the lower master gate within a few hours after it was placed on production. Bringing in a 7000-foot well of a probable daily potential open flow of at least 10,000 barrels oil and more than 150 million cubic feet gas is, even under the most favorable circumstances, no small undertaking; but to cap successfully, without serious mishap to men, the well, or the field in general, such a well, involving the removal of the old christmas tree and replacement with another, is a task requiring almost superhuman effort, courage and skill. How this was accomplished is of more than passing interest at this time, when the problem of well control in deep-drilling, high-pressure areas is assuming a place of ever-increasing importance.

The status of the well and connections when brought in was as follows:

1148 ft.—18⅝-inch seamless casing cemented with 1500 sacks cement.

4909 ft.—11¾-inch, 60-pound seamless casing cemented with 2000 sacks cement (channeling prevented putting in 3500 sacks cement as planned).

5959 ft.— 8⅝-inch, 44.8-pound special high tensile seamless casing, cemented with 500 sacks cement.

4700 ft.—3-inch, 8.9-pound external upset seamless tubing hanging on casinghead.

6876 ft.—Total depth drilled.

917 ft.—Amount open hole below the 8⅝-inch casing.

The well had been washed down back of the 8⅝-inch and up through the 3-inch tubing with clear water and preparations were being made to swab the well down when

**Top to bottom—Christmas tree connections and bracing on Standard Oil Co.'s No. 81, Kettleman Hills Field—this well is an offset to Continental Oil Co.'s Elliott 12-8. Close-up of upper Christmas tree on Continental well. Well hook-up prior to blowing out—note U-bolts around sill tying down lead lines. Double set of lead lines installed after regaining control of well.**

# Hills Was Capped and Controlled

*By*

K. C. SCLATER

it started to flow. This was about 4 o'clock in the afternoon of August 29, 1929. About 7:30 p. m., production from the well was turned into the tanks. At about 11 p. m. something at the casinghead gave way, causing a serious leak and filling the cellar with heavy gas. It was found later that one of the upper flanges had sprung a leak. The cause of the leak is not definitely known, but it is believed that the tubing may possibly have become clogged, whereon the casinghead pressure was boosted suddenly to a dangerously high point and subjected the casinghead connections to stresses beyond their safe limit. What the magnitude of this sudden increase of pressure was is not known. A reading of 2300 pounds was observed on the casinghead gauge by one of the crew shortly after the blowout occurred, so it is quite probable the pressure was much in excess of this. About two hours after production was turned into the tanks, readings of 2000 pounds on the casing and about 650 pounds on the tubing were observed. A sudden increase of casing pressure from 2000 pounds to probably somewhere near the rock pressure (estimated to be at least 3000 pounds) could easily play havoc with the casinghead connections. It could not be immediately ascertained what the trouble was when the well blew out. The spray of gas and oil was so great that the casinghead was unapproachable.

Realizing the seriousness of the situation and the difficulty of the task ahead, preparations for the capping of the well were pursued in a methodical manner. Building of dikes was started at once to catch as much as possible of the well's production and confine it in case of fire. While this work was going on conditions at the well were sized up and plans formulated for capping it.

When the blowout occurred the flow of gas and oil was confined almost to the cellar. However, after a short time the flow between the tubing and 8⅝-inch casing succeeded in cutting large channels in the faces of the flange, some of the flange bolts, and in almost cutting through the anchor bolts. In addition, so tremendous was the velocity of the flow the 3-inch tubing was gnawed through and dropped 2196 feet to the bottom of the hole, leaving only a short

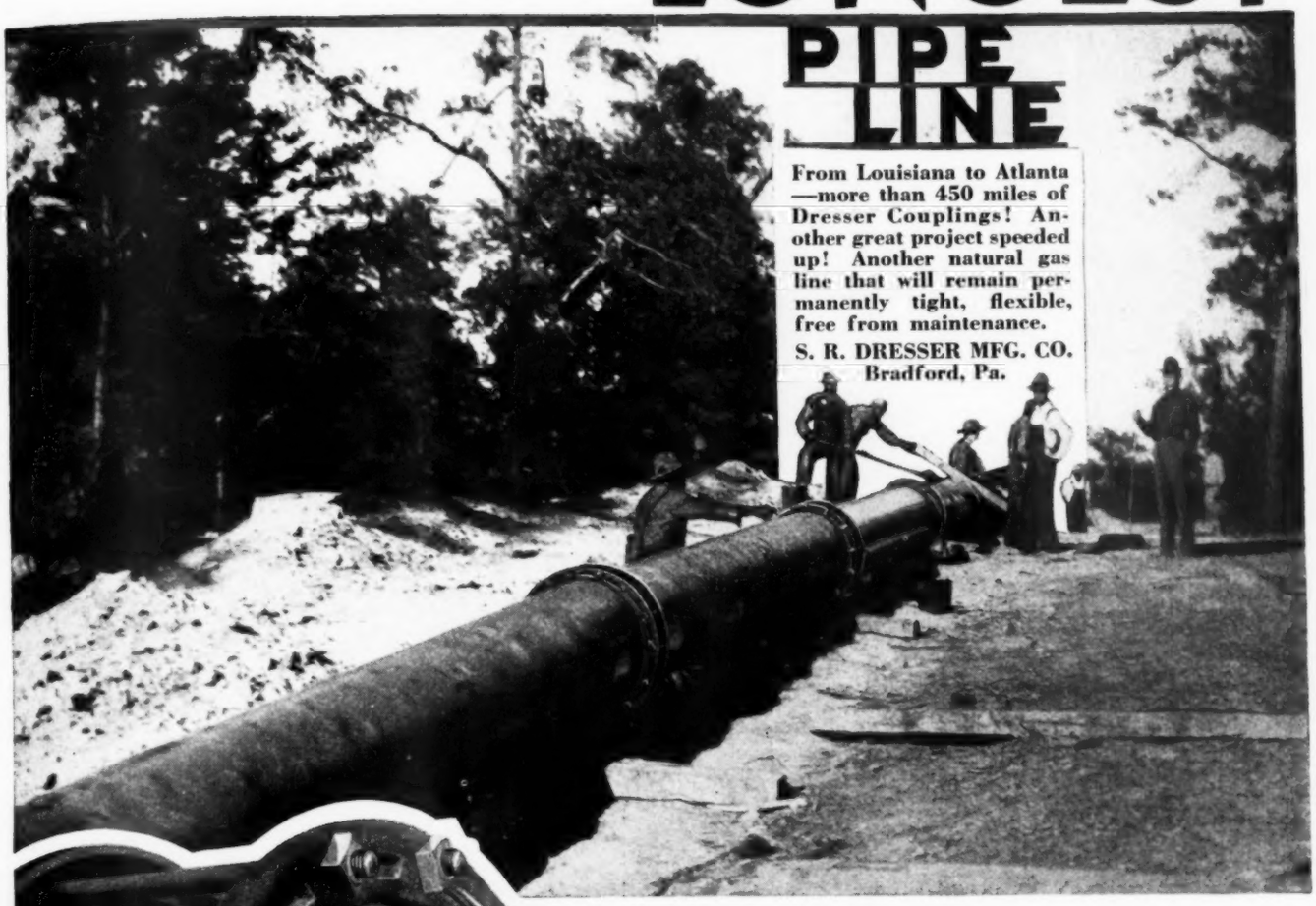
**Top to bottom—Double Christmas tree connection over well. Manipulating the cap into place over well. The valiant crew which fought the well into submission... Carrying on communication by writing notes. 8⅝-inch gate on Christmas tree after mating up.**

piece of 3-inch tubing hanging from the christmas tree flange. With the cutting out of the connections the flow was directed upward. When the bolts of the damaged flange were removed the force of the flow pushed the christmas tree to one side, so that the top leaned toward the front or calfwheel side of the derrick. How to remove the christmas tree and connections was the next problem. It was impossible for anyone, even with a gas mask, to remain in the roaring column of gas and oil long enough to disconnect the flange unions so that the christmas tree could be lifted out. Some other means of freeing the christmas tree had to be found. A brilliant suggestion was then followed; that was to cut through the connections on each side of the christmas tree with a hacksaw, thus freeing it from the flow lines leading from the derrick so it could be lifted out. A hacksaw frame was then made up for the job. A hinge joined the hacksaw and frame, so that the saw could be quickly snapped over the nipple into cutting position on the christmas tree. The hacksaw was operated from the engine house by a rope attached to one end of the saw. To the other end a rope with a weight was attached for pulling the saw back each stroke. While cutting, the frame of the hacksaw hung downward. Wooden trestles, held firmly in place on the derrick floor, with grooves cut in them, served as guides for the rope while actuating the hacksaw. This method proved highly successful and safe. It took only about two hours to cut through an extra heavy 4-inch nipple with walls about three-quarters inch thick. The first cut was made on the pump side of the derrick. Severing the nipple, however, caused the christmas tree to tip slightly toward the side cut and spread the flow of oil and gas so that it impinged on the spot where the nipple was to be cut on the drawworks side of the christmas tree. The result was that the hacksaw could not be held in place in the desired position. A cut was therefore taken between the two 4-inch flow lines instead of between the christmas tree and the two flow lines. This done, it left a 4-inch flow line still connected to the christmas tree; however, a flange union on this line was disconnected without much trouble. A sand line was then attached to the top of the christmas tree, and to the bottom another line, to the other end of which a team of mules was hitched. When the mule team pulled the christmas tree toward the derrick walk and clear of the flow of oil and gas, a gradual pull was taken on the sand line, which was manipulated by one of the crew from the engine house. With the christmas tree lifted clear of the derrick floor, the sand line was gradually lowered, while the mule team pulled steadily on the lower line, thus pulling the christmas tree toward the derrick floor and away from the column of fluid now shooting straight upward. This cleared the way for making a closer examination of the condition of the casinghead, as it was now possible to venture into the cellar. The lower half of the damaged flange was removed, leaving a male threaded connection sticking up which, on examination, was found to be undamaged.

Again did inventive genius come to the rescue. A capping device (see accompanying sketch) of special design was made. When put into use this device worked without a hitch and fulfilled its purpose admirably. A special steel swedge nipple was made to fit the male threaded connection on the casinghead. This was surmounted by the christmas tree. On the nipple connecting the steel swedge and christmas tree a screw-jack arrangement was mounted on a movable sleeve, which could be securely held in place at any desired point on the nipple by set screws. The female threaded collar of the jack was held rigid by two strong straps or links of 1-inch by 6-inch steel, the lower ends of

**Top to bottom—At last! Screwing on—flow now all through upper master gate. Top nipple with ball race started to back off so a chain tong was attached to nipple then secured to bonnet of gate valve. View taken while old Christmas tree still on well. Note fog from well shooting almost straight upward—tunnel entrance in foreground. Christmas tree lying over on its side after cut through with hacksaw before pulled from derrick.**

# On the SOUTH'S LONGEST PIPE LINE



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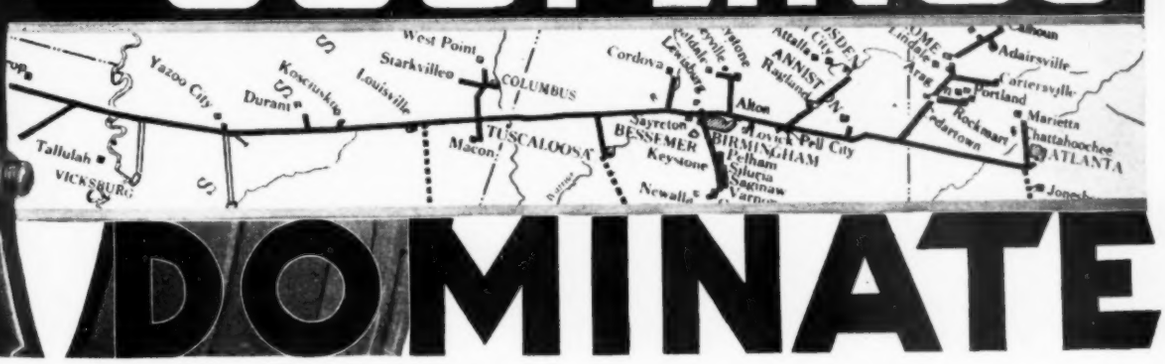
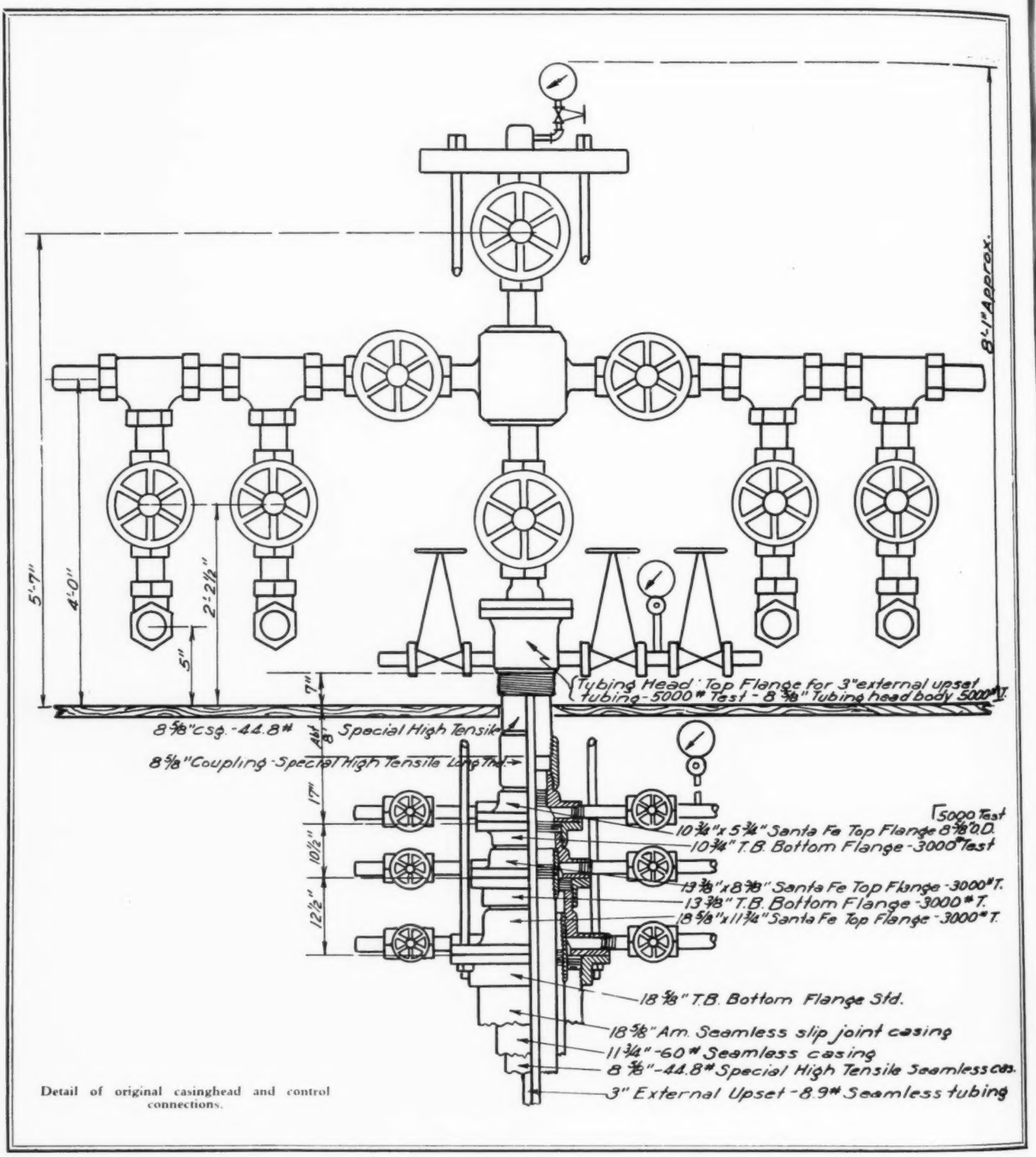




*When writing* S. R. DRESSER MFG. CO. *please mention The Petroleum Engineer*

which were hinged by two studs projecting from a heavy steel clamp attached rigidly to the well casinghead (see accompanying sketch which shows device in position to swing over the well head). The object of the coarse 4-thread screw-jack capping device on hinges was to facilitate the quick placement of the christmas tree over the well. With everything in readiness the christmas tree could be swung over the well in the flow stream and quickly lowered to a stabbing position where the internal thread of the steel swedge nipple would engage the male thread of the casing flange. A nipple was added on top of the christmas tree, on which was mounted a ball race and disc for attaching guy wires. In the first try, centering of the christmas tree by guy wires was done by hand, but in the second and successful try the guy wires were adjusted with block and tackle in centering the capping device. Snubbing lines on the disc were attached through two pulleys to the draw-works. Some trouble was had with the christmas tree whipping the first time the device was used, partly because of the loose fit of the links in the lower studs and partly because of the inability to keep the device centered with guy wires by hand. By lashing the links securely to the christmas tree and using block and tackle on the guy wires the difficulties were removed on the next try. When the


8'-1" Approx.
5'-7"
4'-0"
2'-2½"
5"
7"
8"
17"
10½"
12½"
Tubing Head: Top Flange for 3" external upset tubing - 5000# Test - 8 5/8" Tubing head body 5000# W.
8 5/8" Csg. - 44.8# Special High Tensile
8 5/8" Coupling - Special High Tensile Long Thd.
5000 Test
10 3/4" x 5 3/4" Santa Fe Top Flange 8 5/8" O.D.
10 3/4" T.B. Bottom Flange - 3000# Test
13 3/8" x 8 3/8" Santa Fe Top Flange - 3000# T.
13 3/8" T.B. Bottom Flange - 3000# T.
18 5/8" x 11 3/4" Santa Fe Top Flange - 3000# T.
18 5/8" T.B. Bottom Flange Std.
18 5/8" Am. Seamless slip joint casing
11 3/4" - 60# Seamless casing
8 5/8" - 44.8# Special High Tensile Seamless csg.
3" External Upset - 8.9# Seamless tubing

Detail of original casinghead and control connections.

PERMANENT
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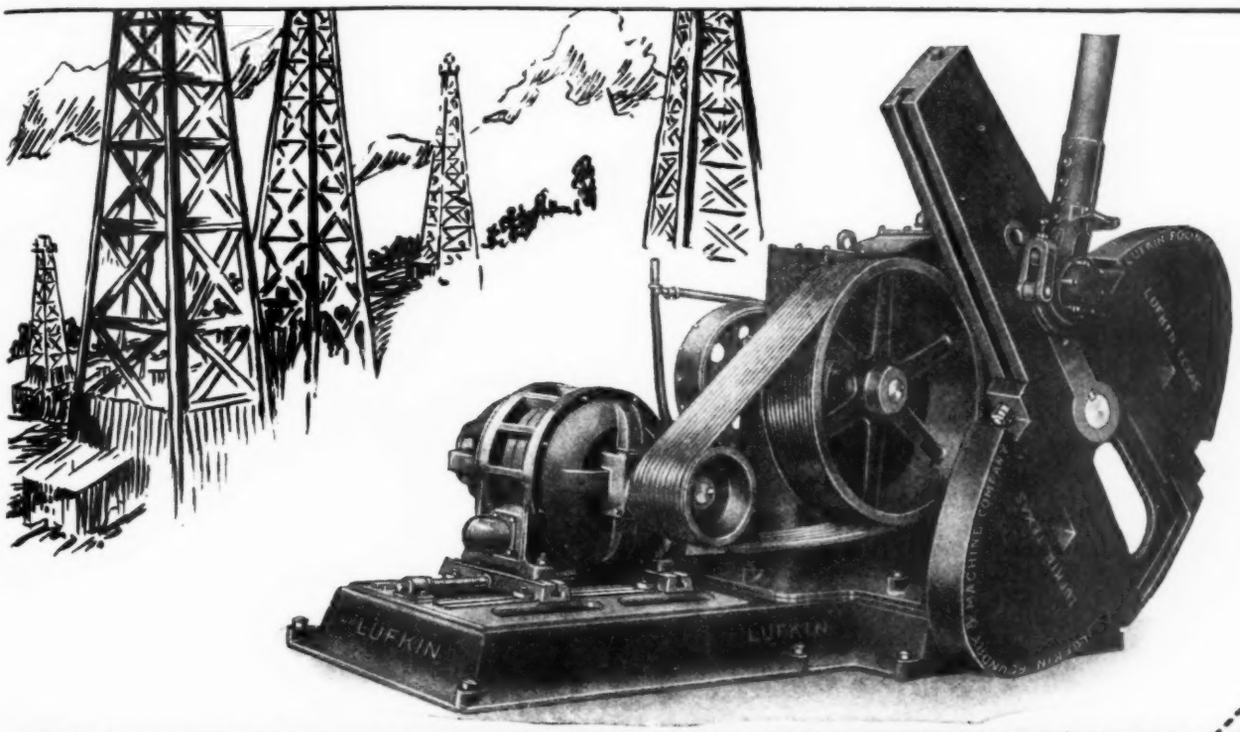
*The*

# LUFKIN HERRINGBONE UNIT

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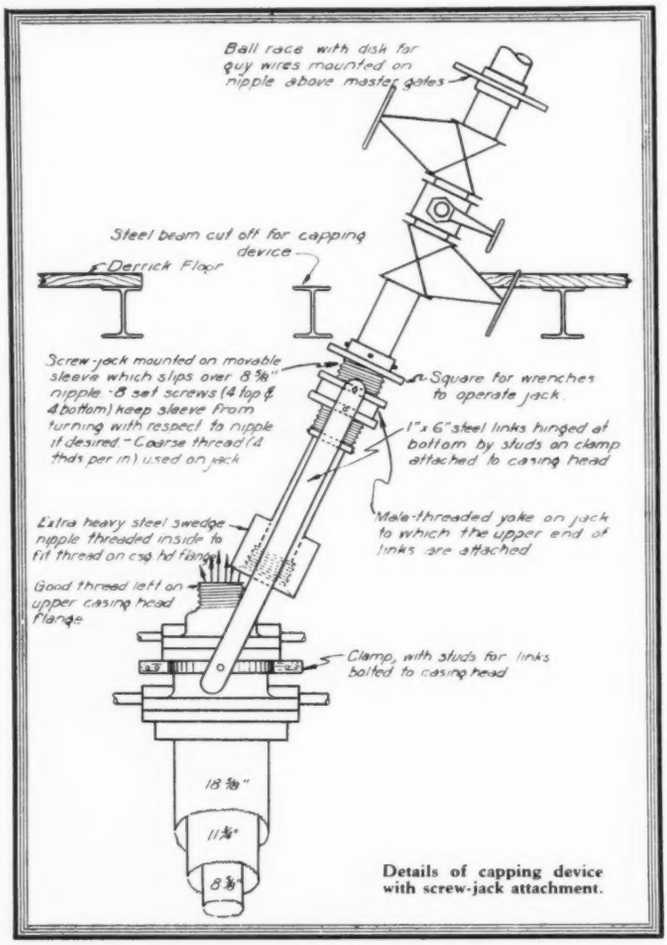
threads were engaged, the set screws on the screw-jack sleeve were loosened and it was only a few minutes' work to screw the christmas tree securely home. So far, so good. The flow was now through the christmas tree and shooting up into the derrick, leaving everything on the derrick floor and in the cellar free from the ravages of the flow of gas and oil. All christmas tree and flow lines were then connected up and securely clamped and guyed.

At this stage the troubles of the crew at the well were far from being over. Serious difficulty was encountered in closing the upper master gate valve against the tremendous pressure. It was necessary to lash timbers to the hand wheel and then to obtain the assistance of every man in the crew. The result was the square of the valve spindle twisted off when the valve was about half closed. Two 48-inch wrenches with 6-foot snipes were then put on the valve spindle. Lines were attached to both wrenches, and to each one was hitched a team of mules. The final stages of the closing of the gate valve became a slow and difficult process. Wire drawing of the fluid when the valve was about closed caused serious cutting of the discs and consequent leakage, with the result that it was decided to add an 8⅝-inch by 4-inch swedge nipple and 4-inch gate valve. Galling of the threads when screwing the swedge nipple into the 8⅝-inch valve caused a leak when the 4-inch valve was partly closed. The swedge nipple could neither be tightened nor backed off as the lower casinghead connections had started to turn when this was attempted. It should be mentioned here that the scouring action of the gas and oil which resembled a giant gasoline spray, removed every vestige of lubricant from the threads. This, in fact, was the chief cause of the trouble with joints made up at the well. A special sleeve clamp was designed to pack off on top of the 8⅝-inch gate valve and the taper of the swedge nipple. Here inventive genius again asserted itself and a satisfactory job was obtained. However, trouble with slight leakage at the 4-inch valve was also encountered because of erosive action of the high velocity of flow. Subsequently another 4-inch gate valve was added, also another Christmas tree made up of 4-inch fittings. This well now has a double Christmas tree, with four flow lines from each and a 6-inch flow line to the traps. All casinghead connections were securely braced before the flow was turned into the traps. As an added precaution the cellar connections were encased in a block of neat cement, 12 feet by 12 feet by 8 feet deep. This was allowed sufficient time to set thoroughly before turning the flow into the traps.


Ball race with disk for guy wires mounted on nipple above master gates
Steel beam cut off for capping device
Derrick Floor
Screw-jack mounted on movable sleeve which slips over 8⅝" nipple. 8 set screws (4 top & 4 bottom) keep sleeve from turning with respect to nipple if desired. Coarse thread (4 thds per in.) used on jack
Square for wrenches to operate jack
1" x 6" steel links hinged at bottom by studs on clamp attached to casing head
Male-threaded yoke on jack to which the upper end of links are attached
Extra heavy steel swedge nipple threaded inside to fit thread on csg. hd flange
Good thread left on upper casing head flange
Clamp, with studs for links bolted to casing head
18⅝"
11¾"
8⅝"

**Details of capping device with screw-jack attachment.**

Extra equipment to handle all the gas produced by the well has been installed, consisting of four high-pressure traps and one large low-pressure trap. The latter trap was installed to handle rich gas coming from the tanks. It has proved effective in eliminating losses from this source. From the time the well broke loose until it was safely under control only 19 days had elapsed. It required about four more days to brace and make the casinghead connections thoroughly safe before turning the flow into the traps. The well has been in continuous operation now for about nine months and the casinghead connections today show no signs of leakage, mute testimony enough to the thoroughness and permanency of the emergency measures used.

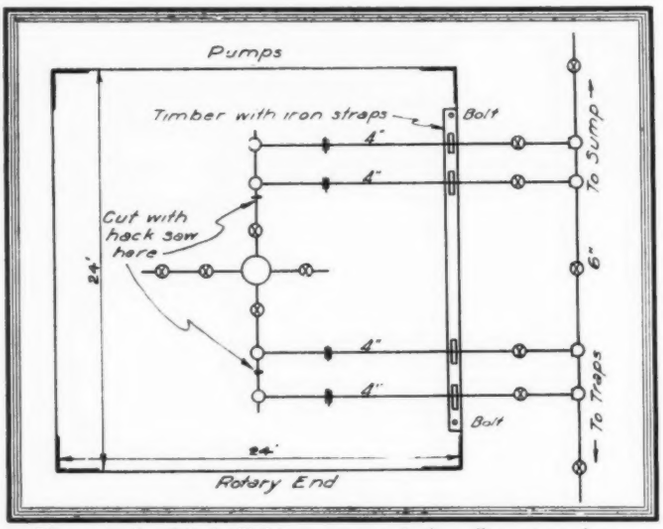



**Diagram of original Christmas tree and flow line connections, showing where Christmas tree was cut with hacksaw.**

While flowing wild, the roar of the well was deafening. Many of the crew were deaf for days after it was all over. Everything around the well, even the very atmosphere, seemed to quiver so devastating was the flow as it emerged from the casinghead. Indeed, the crew were obliged to wear bandages around the head and ears, and a tight bandage under the chin to prevent their teeth chattering. According to one member of the crew, it seemed as if his teeth would shake loose from his head. Just what mental experiences were undergone by the crew while working on the well are difficult to imagine. At first great apprehension of fire and explosion was felt, but this wore off in a short while after working around the well. Within a radius of about two miles from the well all work was stopped.

# Line Walker Operates Field Station

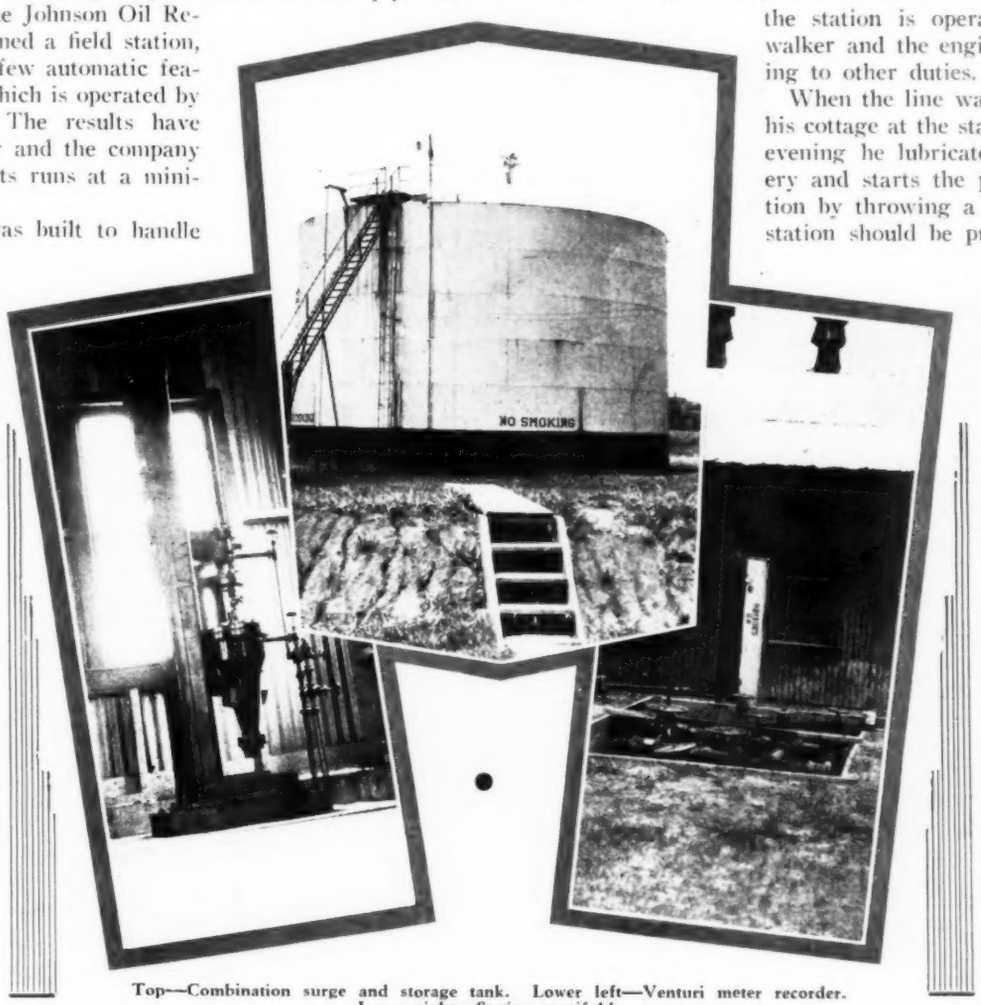
*By* J. H. DAMERON

OPERATION of an abbreviated pipe line system frequently mounts into relatively high pumping costs. Station personnel and evaporation losses are usually the two greatest factors in the high charges for operating such a system. With the view of materially lowering operating charges and reducing evaporation losses, the pipe line department of the Johnson Oil Refining Co. designed a field station, incorporating a few automatic features, and one which is operated by a line walker. The results have been satisfactory and the company is transporting its runs at a minimum cost.

The station was built to handle around 4,000 barrels of oil daily. It pumps through a 20-mile, 4-inch screw-coupled line to the company's refinery at Cleveland, Okla. Crude oil averaging around 37 degrees gravity, is pumped from the fields near Hominy, Okla., to the station.

Station equipment is housed in a sheet iron building and the pump is a 4½ by 8 vertical triplex plunger type pump with a rated capacity of 180 barrels per hour. It is usually operated against a line pressure of 450 pounds, and is driven by a 40 horsepower, 440 volt, three phase, 60 cycle, 860 r.p.m. motor. The motor is mounted on a concrete pedestal and is connected to the pump with a link chain belt.

It was decided to erect only one tank instead of two at the station to keep from handling the oil any more than necessary and thereby reduce evaporation losses. A 10,000-barrel capacity riveted tank to serve as a combination surge and storage tank was built and a Venturi meter installed at a cost less than the estimated cost of two 5,000-barrel capacity tanks. Lines from the field flow into the pump suction and any oil the pump cannot handle goes into the surge tank.




Top—Combination surge and storage tank. Lower left—Venturi meter recorder. Lower right—Station manifold.

When the station was first installed it was operated at peak capacity daily. Since, however, production in adjacent pools has declined and pipe line runs have decreased accordingly. While operating at peak capacity the station was cared for by an engineer, but now that runs are down the station is operated by a line walker and the engineer is attending to other duties.

When the line walker returns to his cottage at the station site in the evening he lubricates the machinery and starts the plant in operation by throwing a switch. If the station should be pumping against a plugged line or should the line break, the automatically operated safety device would function and break the circuit to the motor, and instantly shut the plant down.

This protective device is similar to those installed in automatically controlled pumping stations. It is set by hand to operate whenever line pressure rises or falls above or below a predetermined normal. Thus, in the event the station is pumping against a line pressure of 450 pounds under normal conditions and the safety device is set to operate at 500 pounds or 100 pounds, it would automatically break the circuit to the motor if the pressure exceeded either of the two settings. At the same time the device would start an alarm, or night bell, ringing which would warn the line walker the plant had automatically shut down.

To measure the volume of oil pumped away from the station the line walker does not have to gauge the tank because all of the oil pumped to the refinery is measured through a Venturi meter on the discharge line. This volume is recorded on a chart on the meter.

The practice of measuring the volume of oil pumped through a Venturi tube is found to be within two to three

per cent correct when the meter is in correct calibration. Inasmuch as it was decided to build only one tank this method of measuring the volume pumped from the station was the only means the company had to determine the volume leaving the station.

The surge tank is gauged every morning before the line walker leaves and the difference plus or minus between the volume recorded by the Venturi meter indicates the volume of oil received at the station during that period. This is checked against the runs from the field to determine whatever loss there may be from the time the oil leaves the field until it leaves the station. By a similar check against receipts at the refinery any other losses may be traced.

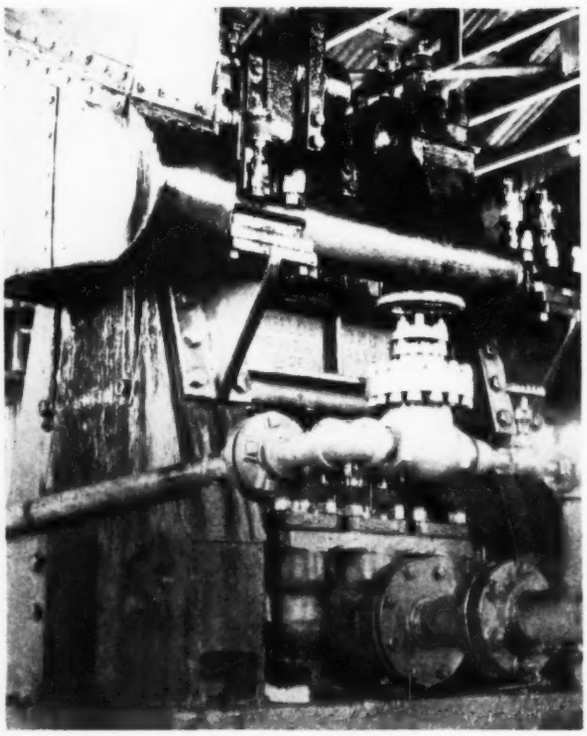
It is station practice to have the lines from the field flow into a header and thence in a 4-inch line direct to the pump suction. Occasionally the presence of considerable gas in the light oil caused a gas bound condition in the pump, which not only seriously impaired deliveries but caused the Venturi meter to operate inaccurately.

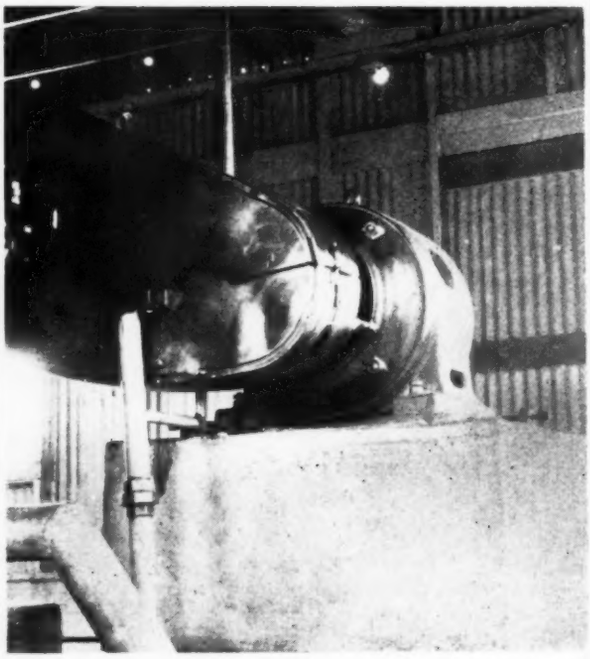
By installing a gas trap on the suction line ahead of the tank connection the trouble was eliminated. The trap was made from a short length of 6-inch pipe swedged down on both ends to 4-inch. A torch was used to cut out the 4-inch flow line to accommodate the fitting and a baffle plate patterned to fit the 4-inch and 6-inch pipe was made. The baffle was welded to the bottom and sides of the 4-inch pipe and 18 inches upward on the sides of the 6-inch.

When the incoming stream struck the baffle, the gas traveled upward through a vent pipe and the oil spilled on over and back into the 4-inch line going to the pump suction. The vent pipe on the installation was extended upward along the side of the tank and through the top. This was done as a safety measure, so, if the oil from the field was pumped against a closed gate it would flow into the tank instead of on the ground, as would be the case if the vent extended in the air.

Whenever it was desired to pump a smaller volume than normal, the station was at a disadvantage because the speed of the pump could not be easily changed. A mechanical change on the pump was not desired because it was not frequently necessary to pump a smaller volume than normal.

This was cared for, however, by putting a by-pass on the pump. The first installation was a 4-inch by-pass from the pump discharge to the suction and controlled with a 4-inch gate. Soon it was found that by using the gate both as a shut off and pinching valve that it cut out and leaked to the extent of preventing the pump from building up maximum pressure when desired.





Above—Motor mounted on pedestal and enclosed belt housing. Below—Valves connected in series on 4-inch by-pass.

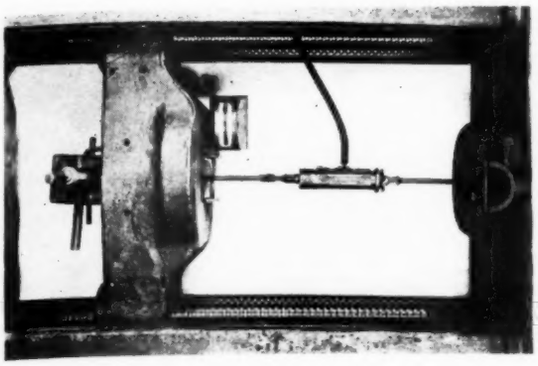
Correction of the trouble was made by using valves in series. Reducers were used to install 2-inch nipples and a 2-inch valve behind the gate. Now the larger valve is used to get a shut off on the by-pass and the smaller valve is used to pinch the by-pass stream. Since the installation of valves in series was made no trouble has been experienced from leaking valves.

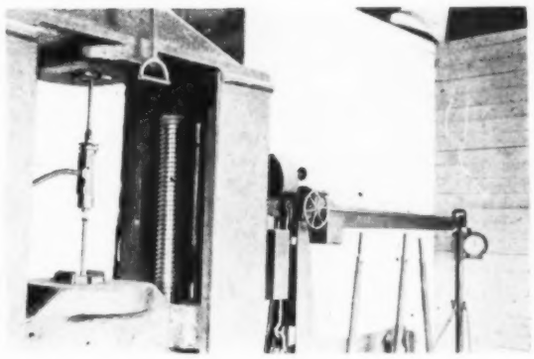
In addition to having a recording meter on the discharge line to measure the volume of oil going through the Venturi tube the station has other automatic recording meters. With the exception of the Venturi meter all of the meters are located on the wall near the pump. One automatically records line pressure and another records the power consumed by the motor and for station lights. A totalizing meter is located near the other meter installations.

Thus, with such an installation, the refining company is in a position to transport its crude from the field at a minimum cost per 1,000 barrels pumped. By being able to operate the station without an engineer the personnel pay roll is pared to the core. At the same time the transporter is reasonably sure the station will not be operated against a plugged line or operate when there is a break in the line. Maintenance cost is low as a result of a mechanical or electrical engineer from the refinery stopping by the station to make an inspection or repairs whenever they make a field trip, and evaporation losses have been lowered to the minimum.

# Rapid Determination *of* Quality *in* SUCKER ROD JOINTS

*By*
P. J.
McCULLOUGH





Left — Method of determining rod temperature, which increased to 200 degrees F., due to action of the vibrator operated by air through the hose, as shown. Right—Riehle testing machine with vibrator used to fatigue sucker rod pins while under a tension load of 25,000 pounds.

WITH the static testing machine and the rotating bar type of fatigue machine very little time is required to make physical tests on metal when standard test bars have been prepared from the specimen. These tests are quite satisfactory in so far as metal quality is concerned, but the results of this kind of a test cannot, of course, be influenced by any weakening or stress-raising effect due to design or to changes in the metal which sometimes takes place during the process of manufacture. Therefore, in some cases it is advisable to make a fatigue test on the finished product.

Oil well sucker rods seem to require the finished-product class of fatigue test to get the most desirable data, but to make a test of this kind in the ordinary way requires a considerable length of time, which may be materially reduced by making such test with a high-speed machine, one type of which is here described.

The machine being used is of 500,000-pound capacity, with a pair of grips to hold the sucker rods under any predetermined load or fiber stress. The fatigue or impulse load is applied at the rate of about 5,000 per minute with a vibrator of the kind generally used in metal foundries to jar large patterns loose from moulds. The complete vibrator weighs about 25 pounds, including a three-and-one-half-pound piston which is the only moving part because it is of the valveless type. The vibrator cylinder heads were drilled and tapped to take an A. P. I. Standard sucker rod pin 1 7/16 inches in diameter with ten threads per inch.

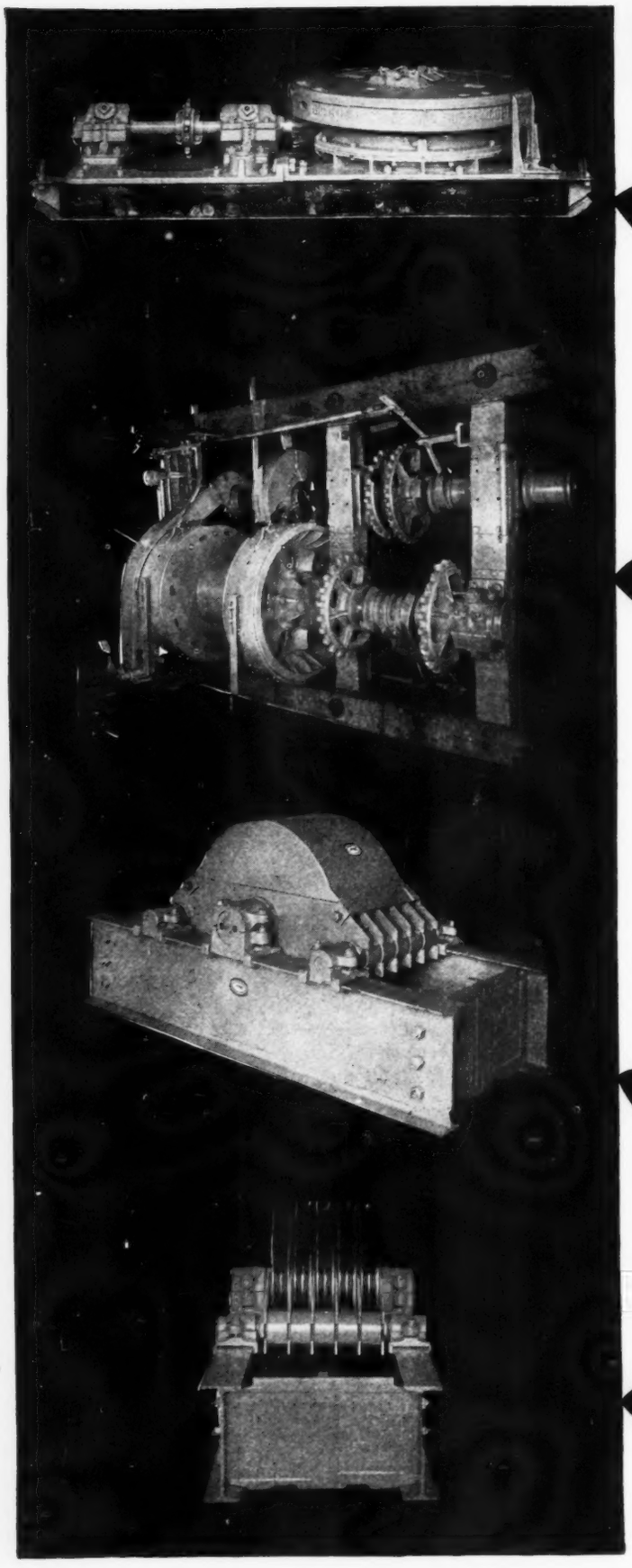
[1] Scullin Steel Company, St. Louis, Mo.

The test is made with short sections cut from the ends of sucker rods, one being screwed into each cylinder-head, making an assembly about five feet long, so placed that when it is in the machine the vibrator will be at about the middle of the distance between the grips of the machine while the test is being made.

Quite a number of sucker rods, including the joint, were tested statically and in every case the fracture occurred in the rod and not in the box or pin, provided the test piece was without flaws. The load required to cause breakage ranged from 40,000 pounds to 60,000 pounds, but when the vibrator was in operation during the test the threaded pin broke in every case under a load of only 25,000 pounds, which was maintained throughout the test by constantly manipulating the slide weight on the beam, which had a tendency to drop while the vibrator was operating.

As compared with the results of a slow-speed sucker rod fatigue testing machine which has been in operation about one year, it seems that each impulse of the vibrator is more destructive than that of the slow-speed machine, which requires about four or five times as many impulses or loadings to cause complete fracture. There is, of course, a critical minimum beam load, not yet determined, below which no noticeable destructive effect would likely be produced by the vibrator, which seems to deliver a hammer blow equal in effect to that produced by striking the joint with a wrench or hammer to loosen the threaded coupling when rods are being taken out of a well; that is, the action of the vibrator always loosens the joint.

Top—Assembly parts for high-speed testing sucker rod joints. Vibrator cylinder, cylinder-head and piston. Box end of sucker rod with double-threaded pin made for test purposes. Rod end with broken pin.



# IDECO-
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### The Rotary

The Ideco-Boykin Rotary will do everything any straight rotary will do and ***in addition*** give you the make and break feature ***plus*** the fishing job feature. With this last named feature you can come out of the hole without twisting or rotating the pipe.

The Ideco-Boykin Rotary has an unusually fine oiling system—oil bath easily and completely drainable. Mud cannot get into the bearings to cause undue wear. Rotary table is built low to make it easy for driller to pull slips. Made in 19, 23 and 27 inch sizes.

### The Draw-Works

No draw-works are easier or safer to operate than the Ideco-Boykin. Clutches are shifted by foot, leaving the hands free. The large brake surface, air cooled, is so positive and easily controlled that a man can hold with one hand 6000 feet of pipe without effort. The big diameter of the spool makes for less wear on the wire line.

A remarkably fine oiling system, lubricating all working parts contributes to the ease of operation. The Ideco-Boykin Draw-Works runs smooth and runs fast, yet is always under perfect control. The shafts, special analysis steel, are ground and polished. Chrome nickel, clutches and sprockets are heavy and substantial.

Made in two sizes—"Regular" for operations up to 4,000 feet and the "Big Texan" for deep well work.

### The Crown Block

The Ideco-Boykin Straight Line Crown Blocks with Idecalloy or Manganese Steel Sheaves represent the latest development in heavy duty crown blocks. Running on American roller bearings, the large diameter sheaves save power and materially increase the speed of operations. Each sheave is individually lubricated by the Alemite pressure system.

The sheave assembly is adjustable after the block has been mounted on the derrick. With ease and assurance you get perfect alignment of lines with the center of hole.

Mounted on 18-inch galvanized structural steel frames.

The IDECO Straight Line, Heavy Duty Crown and Streamline Traveling Blocks make combination units unequaled for speed, power and economical operation.

In addition to a complete line of straight line crown blocks, IDECO also offers a line of staggered blocks with or without roller bearings made of cast iron Idecalloy or Manganese Steel, ranging from small pumping blocks to 7 and 8 sheave combination drilling blocks.

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### The Traveling Block

No load is too heavy nor speed too fast for the Ideco-Boykin Roller Bearing Traveling Block. The Blocks are streamlined and of the over-balanced type, proportioned to prevent overturning or fouling of the lines. Heavy in weight to insure rapid descent in the derrick without load. Sheaves are equipped with American Heavy Duty roller bearings with individual Alemite grease connection to each bearing. 36″ Manganese Steel Sheaves reduce the bend in the line and prolong wire line service. The lines being perfectly straight eliminate side drag and friction.

### The Reduction Gear Unit

The heaviest oil field requirements can be successfully handled by the Ideco Geared Unit. Wherever power is required—drilling, reworking, pumping, pulling rods and tubing—this Ideco Geared Unit can be relied upon to transmit the necessary power quietly, economically and efficiently. Built with 100% overload capacity for starting and intermittent periods.—Designed to transmit 96% to 97% of the power at full load.—Simple and compact, the Ideco Geared Units are oil-tight, dirt-proof, free from vibration and noise, and are outstanding for their high mechanical efficiency.

### Bull, Band, Calf Wheels

Ideco Wheels have been a standard item of equipment with the oil man for so long that they are generally accepted as the standard of reliability. Even so, as changed conditions warranted improvements, these changes have been made. For instance Ideco has developed a 24″ Band Wheel which permits the use of a wider belt of thinner structure, creating longer belt life. Ideco Wheels conform throughout to A. P. I. specifications.

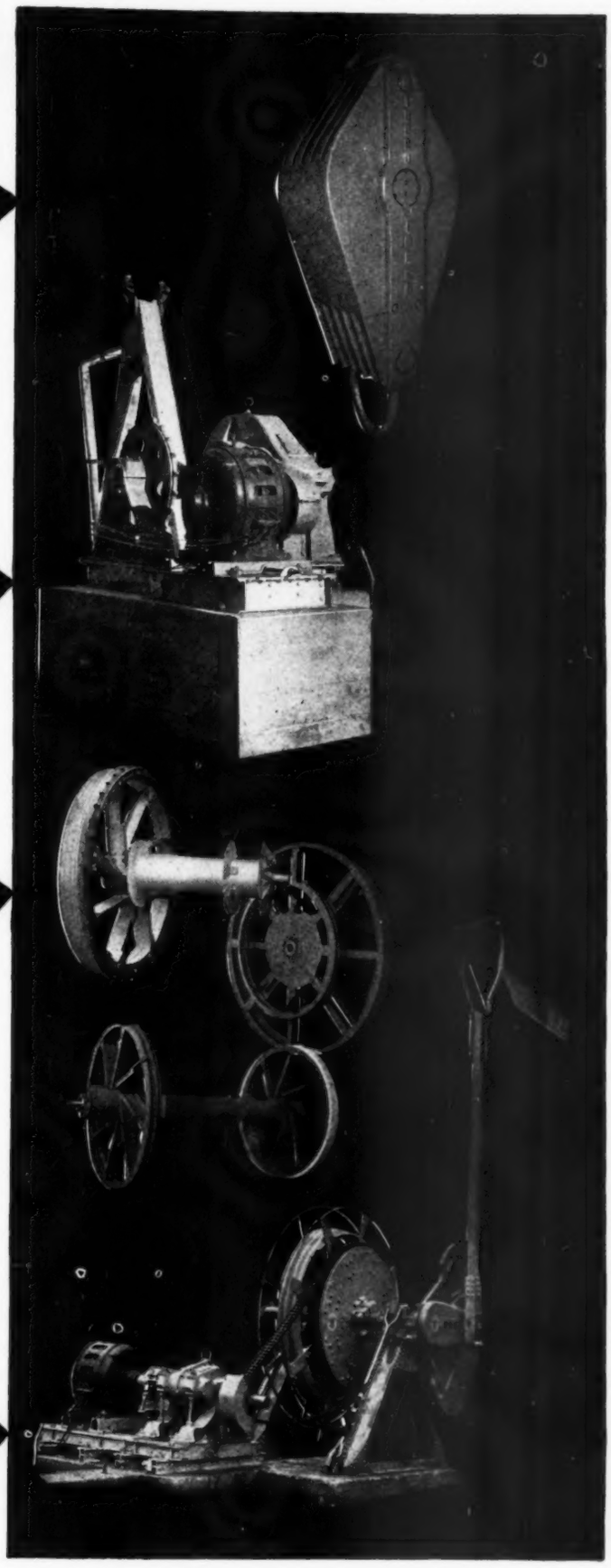
### Chain Rig Pumping Units

The Ideco Chain Rig is a compact, powerful unit built entirely of steel and resembles in many respects the standard type of drilling or pumping rig. Ample strength, simplicity of design and unusual freedom from wear are outstanding features.

A complete IDECO Chain Driven Rig consists of a chain wheel; crank and shaft; standard "A" Frame jack posts with roller bearings; "A" frame Sampson and headache post; walking beam; pitman and long stroke crank counterbalance. Provision is made for installing a chain driven sand reel if desired. A single reduction geared unit is offered for use with any electric motor or high-speed gasoline engine; or jackshaft units are provided where gas or steam power is used.

This rig provides a portable, trouble-proof drilling or pumping unit that can be economically installed, operated and kept in continuous operation.

Bulletins describing the above equipment will be forwarded upon request.



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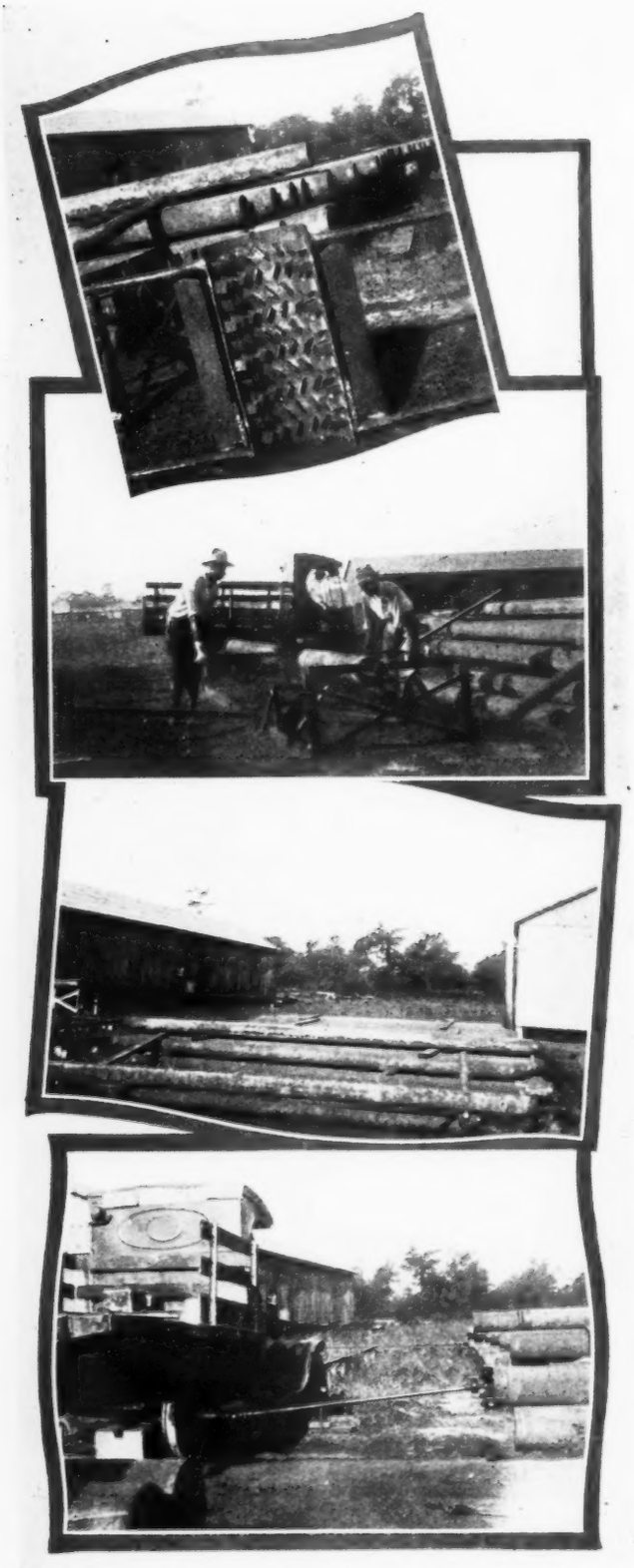
## *Gas Company Finds*

# Pipe Cleaning Machine Effects Economics



Top to bottom—Close-up view of file head, showing how points are welded in. Workmen moving file head over joint of pipe. General view of field ramp. Showing power take-off connected to truck wheel and drive shaft.

AN unusual and inexpensive line pipe cleaning apparatus was built and is being used extensively by the Southern Carbon Co., in the great Monroe gas field in northeastern Louisiana. The apparatus was designed by V. F. Sackett, superintendent of the gas department. Because of its portability it may be readily moved from one field warehouse to another, and is economically reconditioning old pipe from main and gathering lines that have been taken up.

Briefly, the apparatus is one which uses the power from a Model T Ford truck to rotate a joint of pipe on rollers while workmen move a file head back and forth over the pipe. The file head knocks off rust and scale and the pit holes are cleaned by two additional workers using wire brushes. The pipe is painted with a priming coat and stored for future use.

The truck is maneuvered into position and the wheels blocked to prevent it from moving forward or backward. The rear end is jacked up and one of the tires removed. A power take-off designed to fit between the spokes of a rear wheel is bolted securely to the wheel. It is connected to a drive shaft with a flexible coupling. The chuck, used to rotate the pipe, fits snugly inside the pipe and is clamped tight with nuts as illustrated in one of the accompanying photographs. A flexible coupling is used to connect the chuck to the drive shaft.

The file head was built with a halved short length of 12-inch pipe with hard steel file points welded inside. After the short length had been cut from 12-inch pipe a torch was used to halve it lengthwise. File points or teeth were cut from special treated hard steel and welded inside the head and the head welded to a specially built cradle. There are 72 file points in the head and their average wear is around 400 joints of 8-inch pipe.

A rolling frame was built with rollers in each end to make the pipe easier to rotate and to hold it while rotating. The frame and rollers were so designed to permit full travel of the file head over a joint of pipe.

On an average operation six minutes is required to clean a 21-foot joint of 8-inch pipe. The truck motor is run at slow speed in high gear and the file head is moved the full travel length twice. Going over the joint twice thoroughly cleans the pipe of rust and scale and loosens the material in the pit holes.

Following this operation the joint is rolled over on a ramp where two workmen clean it with wire brushes. As the joint moves along the ramp others apply a priming coat.

Portability is one of the attractive features of the layout and which makes it readily adaptable for work in the gas fields in that section of Louisiana. It may be readily loaded on a truck and moved to a new location, set up and in operation within a few hours.

[redacted]

[redacted]

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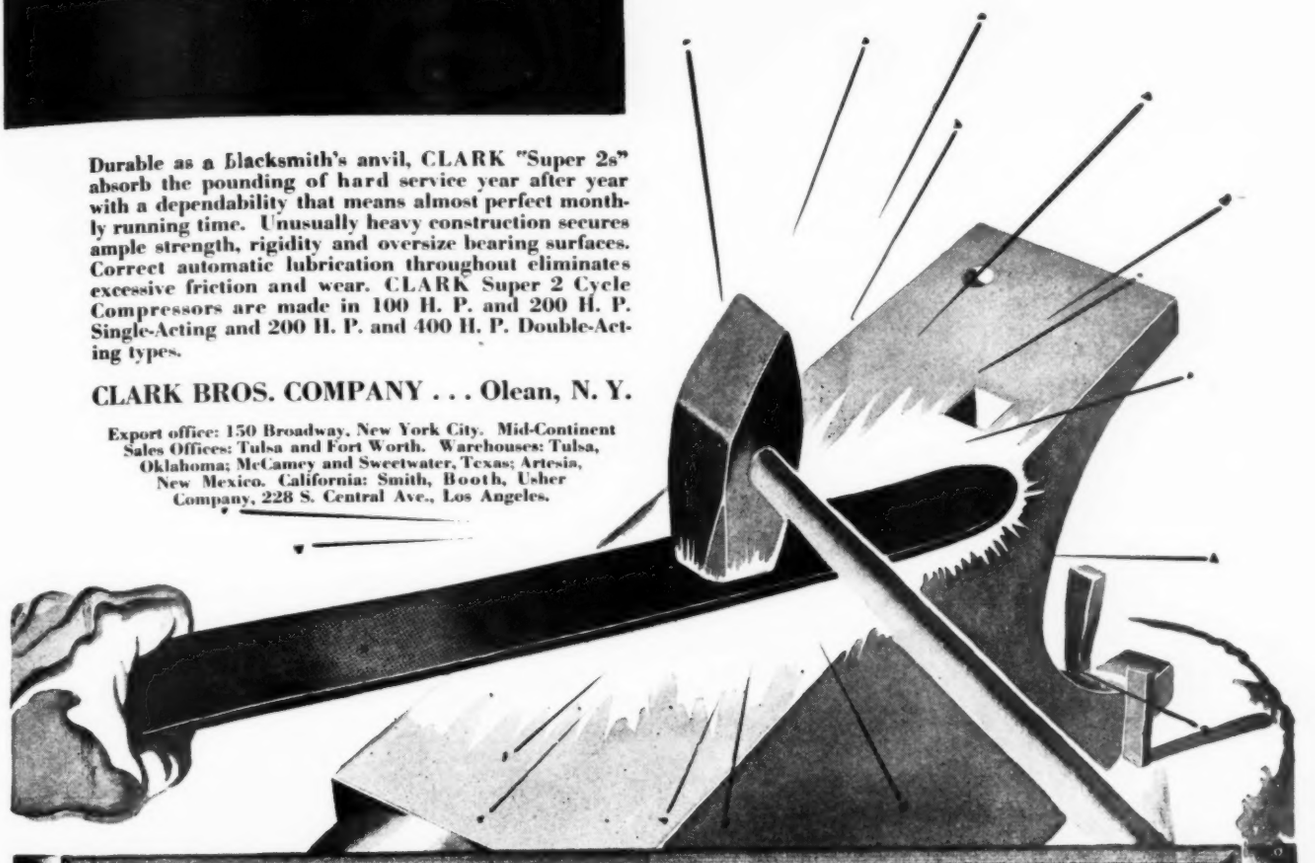

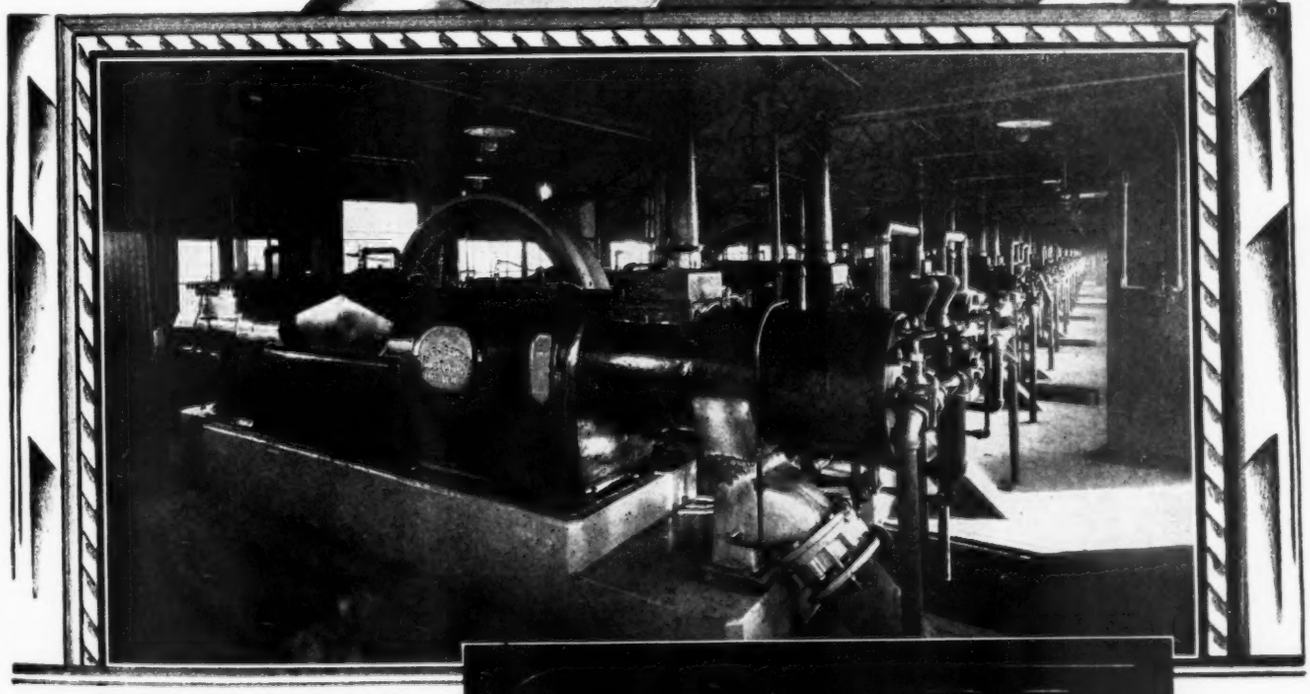

**200 H. P. "Super 2s" in the I. T. I. O. Vern gasoline plant at Oklahoma City.**

[redacted]

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# Rig Set-Up and its Effect on Power and Stress in Counterbalancing Wells

*By* A. L. FABER[1]

A STUDY of well counterbalancing should include a study of the rig set-up itself, as variations in counterbalancing results can be traced to the rig setting. This is especially the case on a rotating or pitman type of counterbalance, and is occasioned by the fact that the shaft is set with respect to the walking beam instead of with the line of rotation of the walking beam.

In order to study this phase of well counterbalancing and determine the rig setting for a minimum power input and minimum stress, a layout to scale as shown in Fig. 1 was made. As the findings would be relative, the following arbitrary setting was chosen:

Working centers on walking beam, 14 ft.

Vertical distance between walking beam, saddle center and pitman, 26 in.

Length of pitman, 10 ft. 6 in.

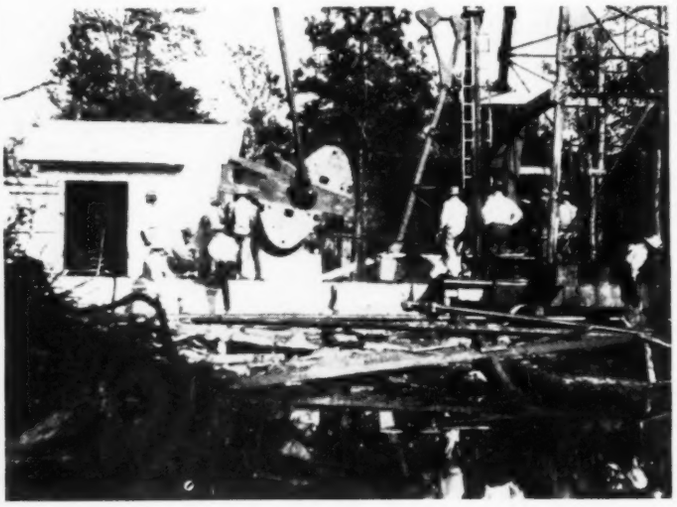
Length of stroke, 72 in.

Four positions of the crank center or jack-shaft center were taken and vector diagrams of forces plotted for 16 positions of the crank. Again, because the findings would be relative, a constant force was assumed instead of the variable forces encountered in well pumping.

In Fig. 2 the relative value of this constant force tangent to the operating arm is shown. Position I, it will be noted, is the usual rig set-up and vector the force was plotted for both clockwise and counter-clockwise operation. Both in clockwise and counter-clockwise operation the rod load was plotted from crank position zero to 180 degrees. From an examination of the plotted values it is evident that minimum power requirements are obtained on counter-clockwise rotation with rig set-up as in Position I. A further study shows that the point of minimum power and minimum stress is obtained in Position III, or when the crank or jack-shaft center is on a line at right angles to the operating arm when the walking beam is horizontal. In addition the vector force diagram shows that with this set-up there is no difference in clockwise and counter-clockwise operation. Because of the fact that standard equipment is designed for clockwise operation of the crank, the set-up as per Position III is recommended.

It is to be noted with the set-up of Position III that the same length of stroke is obtained on the polished rod as on the pitman within the practical limits permitted by the rod hanger position. That is, where 14-foot working centers are used the polished rod and crank strokes will be the same, whereas, in Position I, the polished rod stroke will be shorter than the pitman stroke.

In Fig. 3 is shown a power input curve with a walking beam curve superimposed. This is again published because it is most interesting to note the maximum effective vector force. Fig. 2 comes



Pumping well and typical field view in Arkansas field.

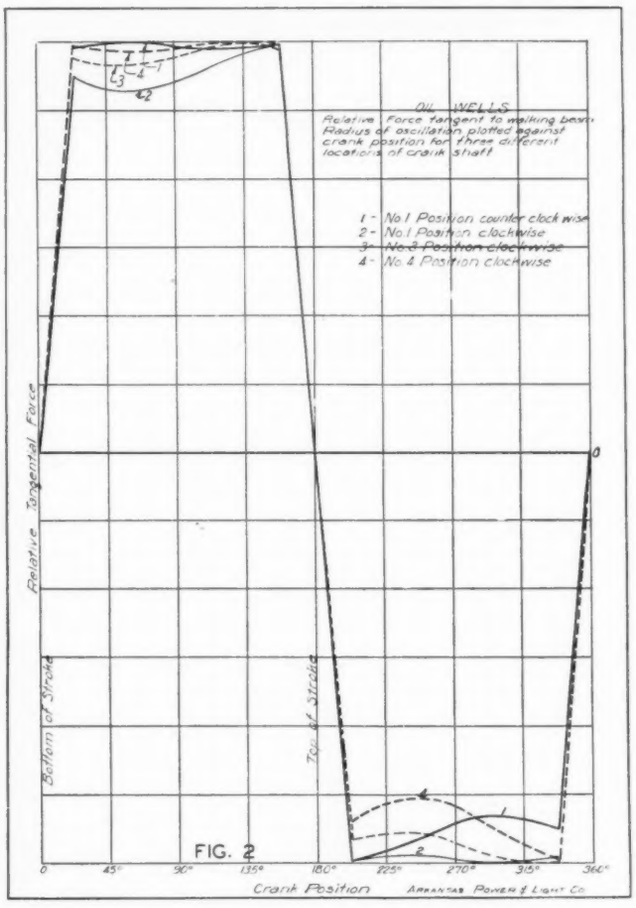



FIG. 2

[1] Arkansas Power and Light Co., Pine Bluff, Ark.

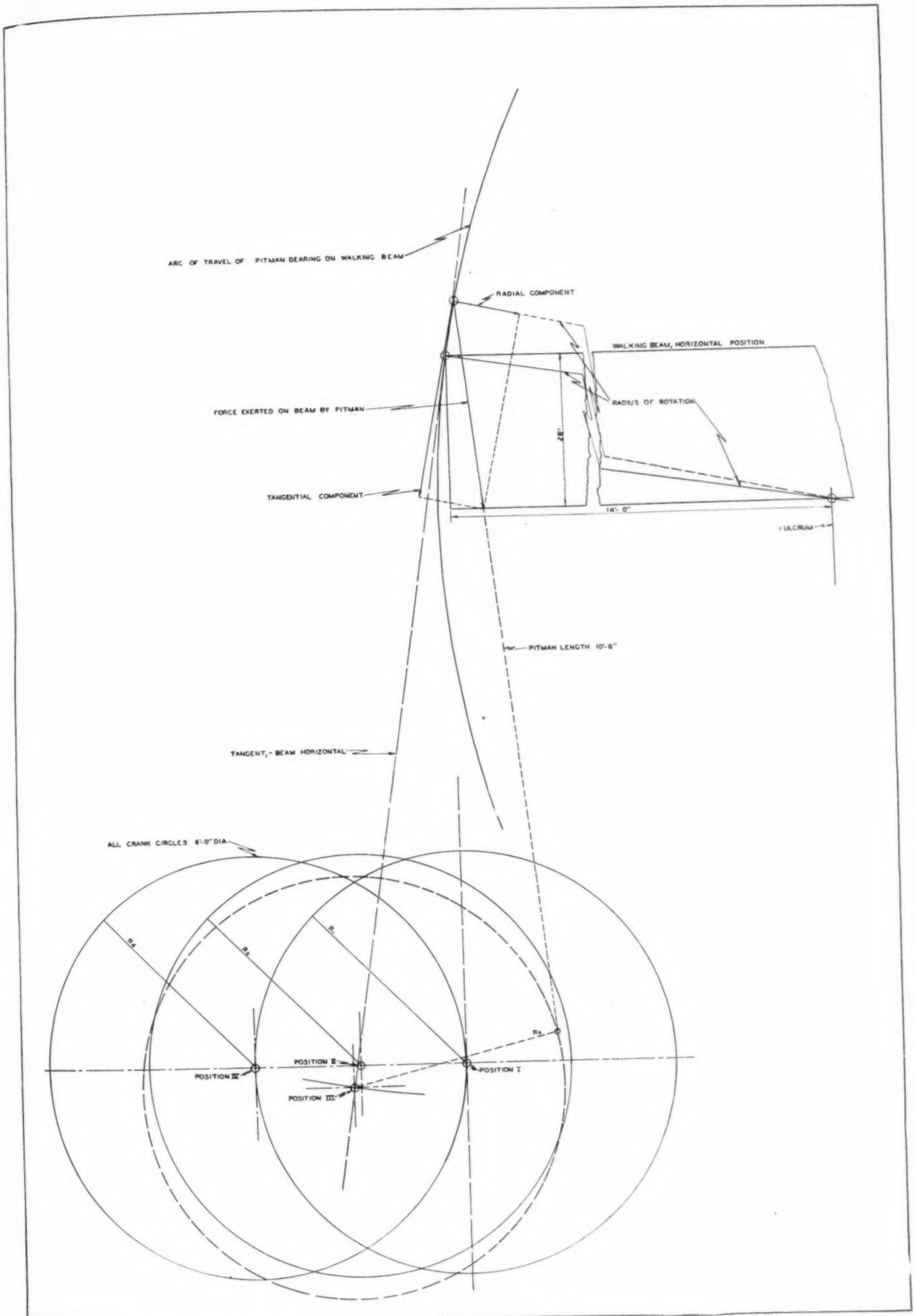

ARC OF TRAVEL OF PITMAN BEARING ON WALKING BEAM
RADIAL COMPONENT
WALKING BEAM, HORIZONTAL POSITION
FORCE EXERTED ON BEAM BY PITMAN
RADIUS OF ROTATION
TANGENTIAL COMPONENT
28"
14'- 0"
FULCRUM
PITMAN LENGTH 10'-6"
TANGENT, BEAM HORIZONTAL
ALL CRANK CIRCLES 6'-0" DIA.
R4
R3
R2
R1
POSITION II
POSITION I
POSITION III
POSITION IV

Fig. 1

between 135 degrees and 180 degrees for Position III, which covers the range of maximum input power.

It was already stated that an arbitrary layout was made to figure the correct position of the jack shaft center for any other walking beam and pitman lengths. It will be noted that on the 14-ft. walking beam center and 10½-ft. pitman, the jack shaft should be set back 1.6 feet, that is, the distance from the center of sampson post to center of jack shaft should be 15.6 feet, Position III, and 4 inches below usual set-up. In this position there will be no difference between clockwise and counter-clockwise operation of the crank, and minimum power and minimum stress will be obtained. Trigonometric formulae are not presented because the writer believes it is simpler to make a graphic layout to scale rather than calculate this problem.

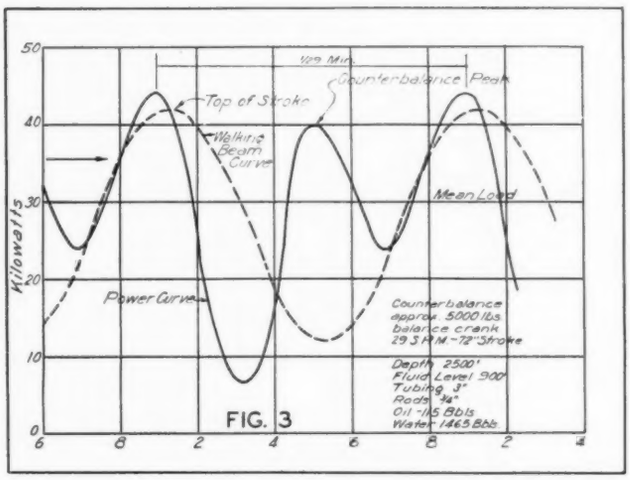


FIG. 3

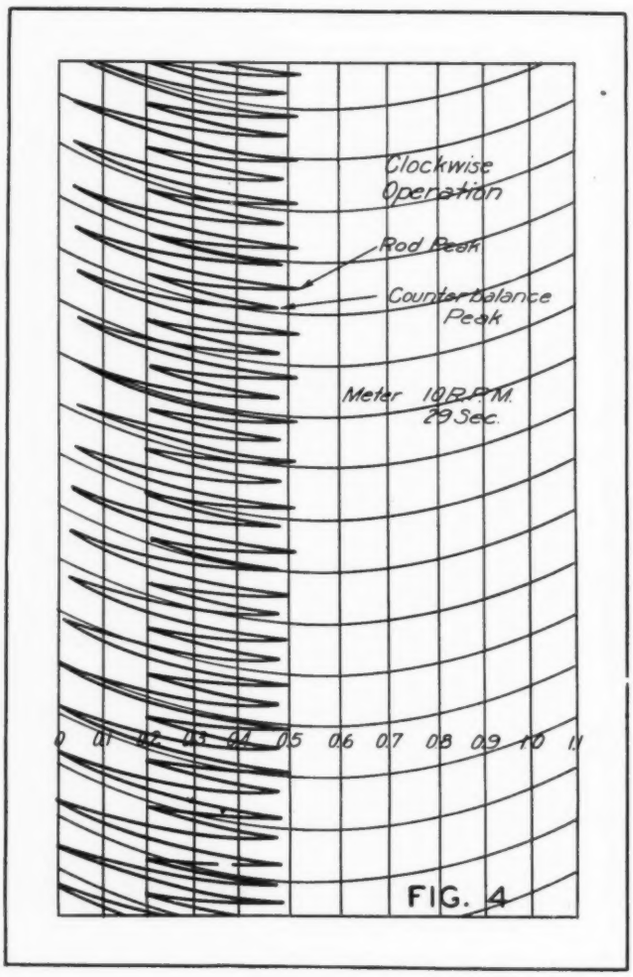


FIG. 4

### *Power Curves on Clockwise and Counter-Clockwise Operation*

In studying the problem of running wells backwards or counter-clockwise with the usual rig set-up and rotary type counterbalance two conditions are met.

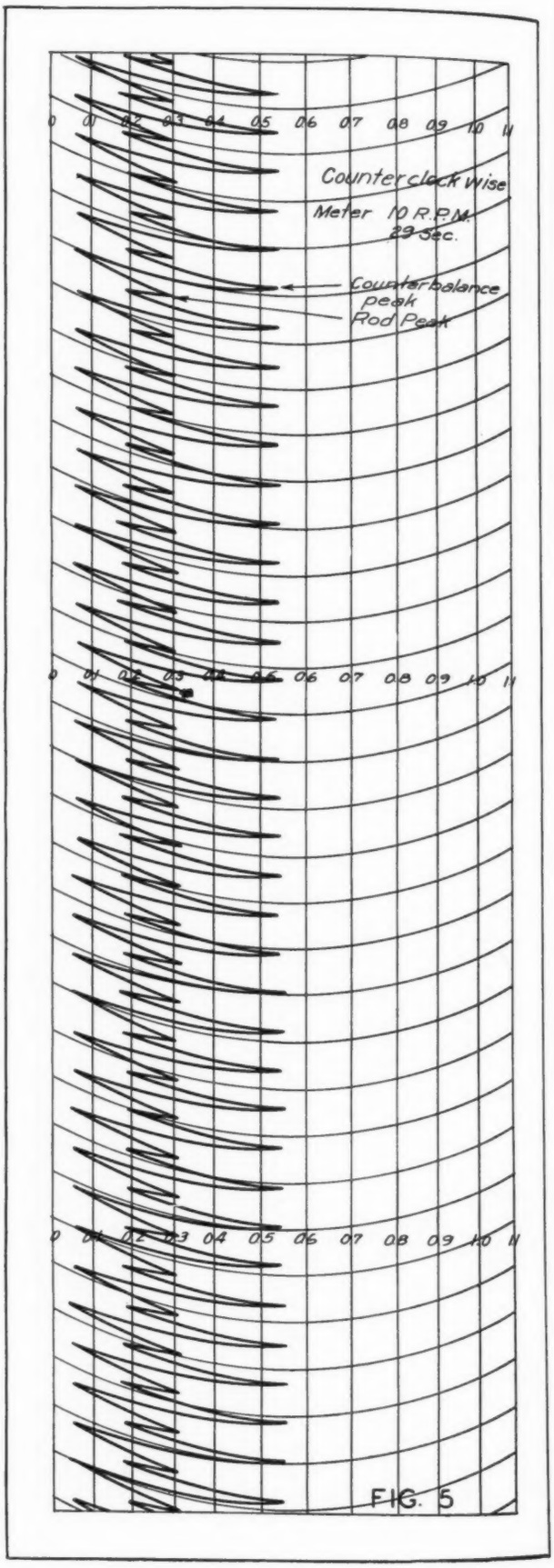


FIG. 5

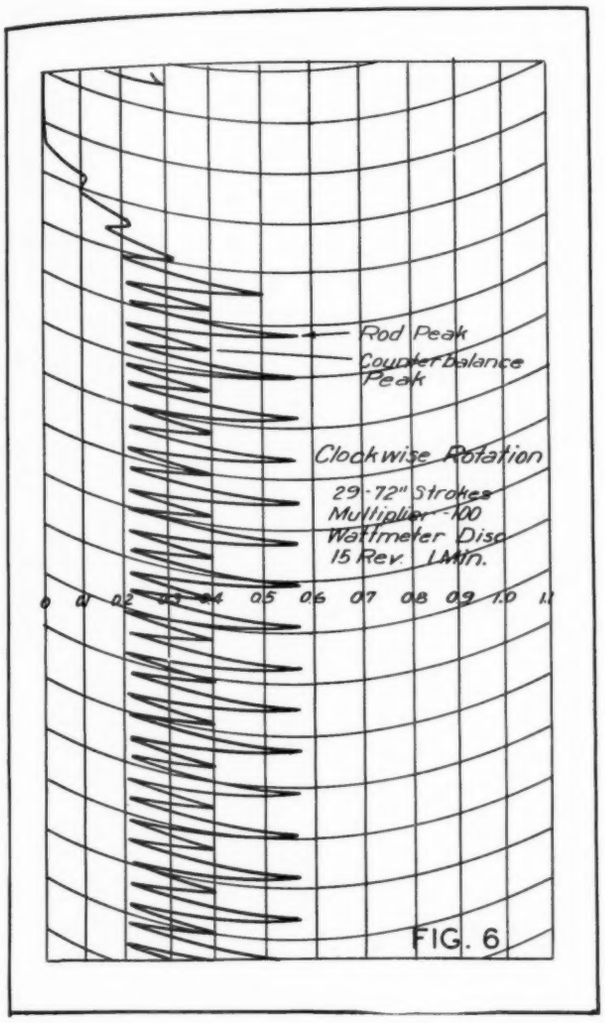


FIG. 6

1. Well counterbalanced running forward or clockwise.

2. Well under-counterbalanced running forward or clockwise due to inability to put enough weight on the rig.

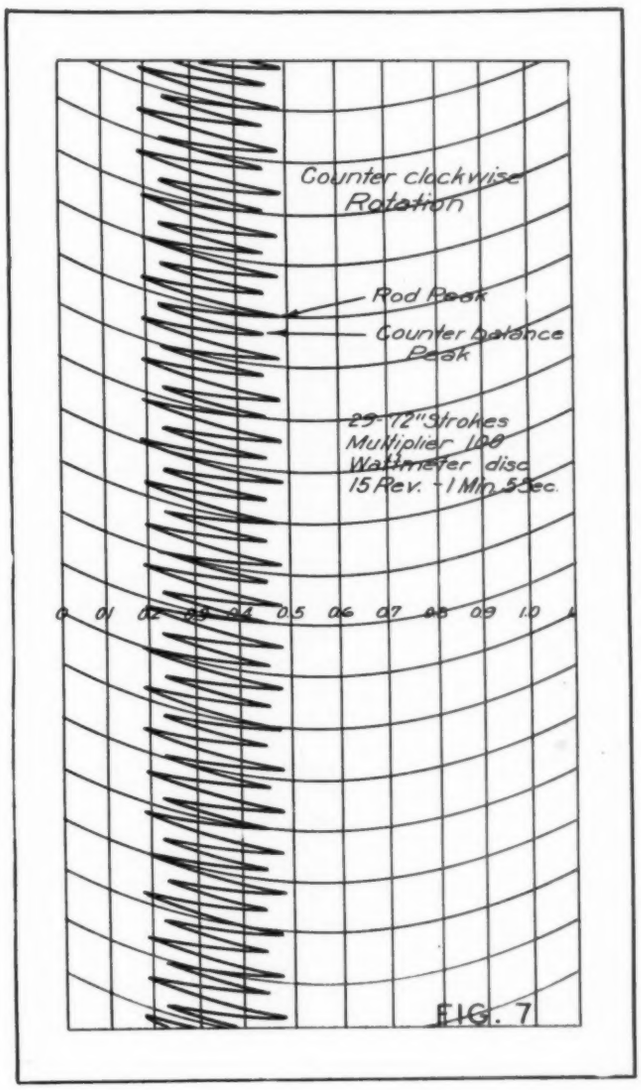
Fig. 4 shows power curves on a well that is counterbalanced running forward or clockwise. Fig. 5 shows the same well operating backwards or counter-clockwise under the same conditions. It will be noted that no power is saved by counter-clockwise operation since the K.W. hours used are the same as by clockwise operation. An interesting feature to note is the distortion of the power curve with the same weight of rotary counterbalance. The counterbalance peak increased to 52 K.W. and the rod peak dropped to 30 K.W. On the clockwise operation the rod peak goes to 50 K.W. only and the counterbalance peak to 48 K.W. The consumption of power, however, is the same.

Fig. 6 shows the power curves on a well under-counterbalanced due to lack of weight. This well is operating at 29 72-inch strokes with three-quarter-inch rods in three-inch tubing. Under the conditions as operated the rods would not fall at this speed. Fig. 7 shows the power curves on the same well under the same well conditions but operating counter-clockwise or backwards. It will be noted that the well is counterbalanced and the rods are falling smoothly. Rig vibration was practically eliminated entirely and the K.W. hours required to operate were cut down 8 1/3 per cent. As the findings shown by typical curves have not varied in a number of tests under widely different well conditions, we are prepared to state that with the usual rig set-up, a well can be counterbalanced with less weight on a rotary type of counterbalance when operating counter-clockwise than when operating clockwise. Also, where a well is balanced operating clockwise, no saving is made by counter-clockwise operations.

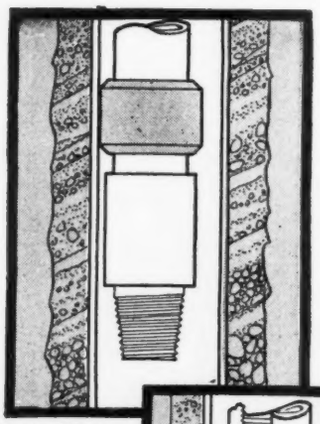
### *A Short Cut to Counterbalancing*

*By the use of a stop watch the counterbalance of a well can be checked quickly and effectively by timing the crank from top-center to bottom-center and bottom-center to top-center. It is found that when the difference in time between the up-stroke and the down-stroke is one-fifth of a second the power-input curve shows a minimum power requirement. The timing of the crank on curve shown in Fig. 6 shows four-fifths of a second difference between the up-stroke and the down-stroke, indicating that the well is under-counterbalanced. The timing of curves of Fig. 7 shows a difference of one-fifth of a second between the up and the down strokes. The result as shown has been checked on enough different wells to warrant the conclusion reached.

*Acknowledgment is made to Mr. L. B. Holland of the Phillips Petroleum Co., Bartlesville, Okla., for originating this idea.


Counter clockwise Rotation
Rod Peak
Counter balance Peak
29-72" Strokes
Multiplier 100
Watthmeter disc
15 Rev. - 1 Min. 55 Sec.
0 01 02 03 04 05 06 07 08 09 1.0
FIG. 7

# 8 applications of



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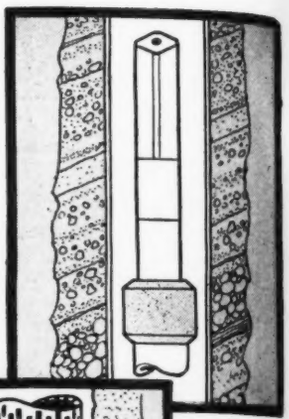
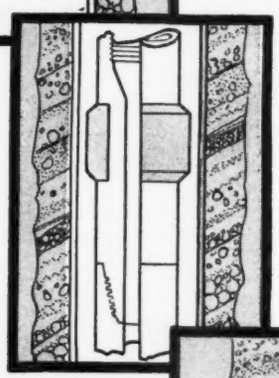
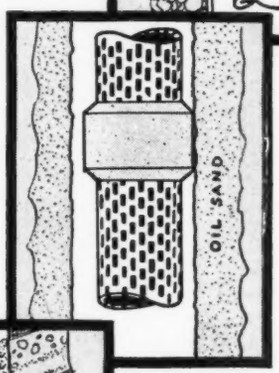


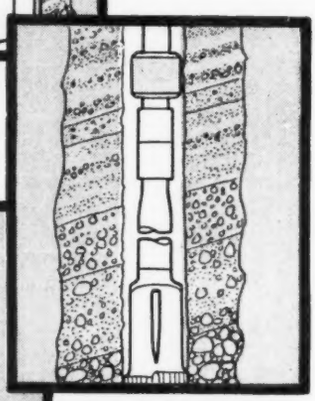
Bettis Protector on Kelly sub to prevent whipping.



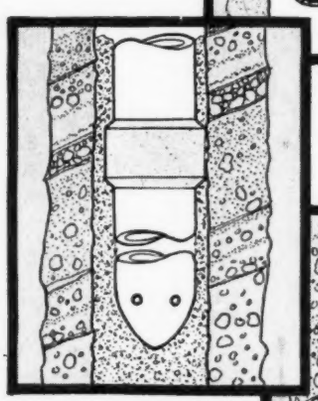
Bettis Protector on Hopkins Anti-friction Tool Joint.



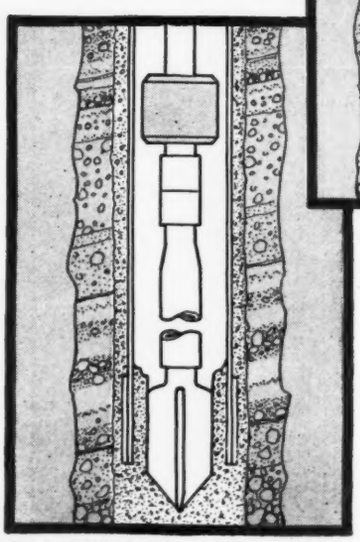

Bettis Protector on perforated liner to center same.



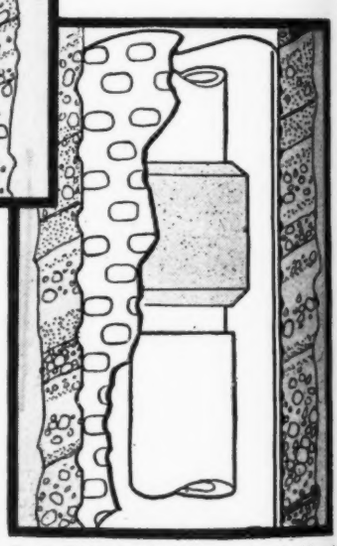
Bettis Drill Stabilizer on drill stem.



Bettis Protector on casing, in cement job to prevent thin walls.



Bettis Drill Stabilizer on stem drilling out cement plug.



Bettis Drill Stabilizer on casing inside of large diameter stove pipe casing.

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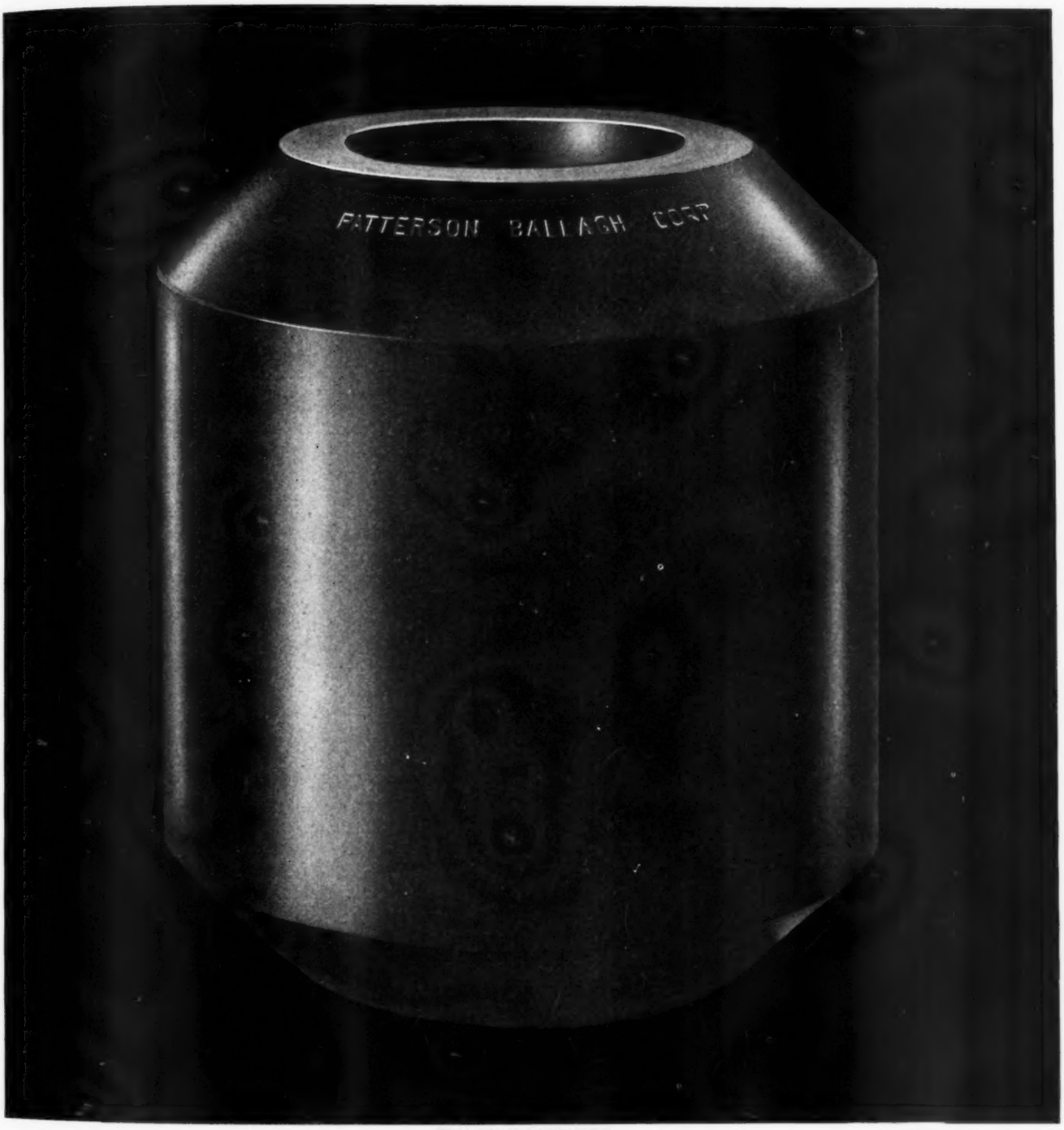


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# & Drill Stabilizers

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# Gasoline Pipe Line Operates *at* High Pressure

THE Canadian River Gas Co. operates a 75,000,000-cubic-feet gasoline absorption plant at its Bivins Station near Channing, in the Texas Panhandle. The natural gasoline made at this station is loaded at Amarillo through a thirty-mile pipe line. This is a two-inch welded line. It is operated against a line pressure of 700 pounds.

A storage capacity for the finished product of 100,000 gallons is maintained at the plant and 200,000 gallons tankage at the loading station.

The plant produces about 15,000 gallons of grade AA natural gasoline per day. All of the gasoline is stabilized to this grade. The stabilizer is operated under a pressure of thirty pounds per square inch. The gasoline content of the raw gas tests from 0.3 to 0.4 gallons per thousand cubic feet.

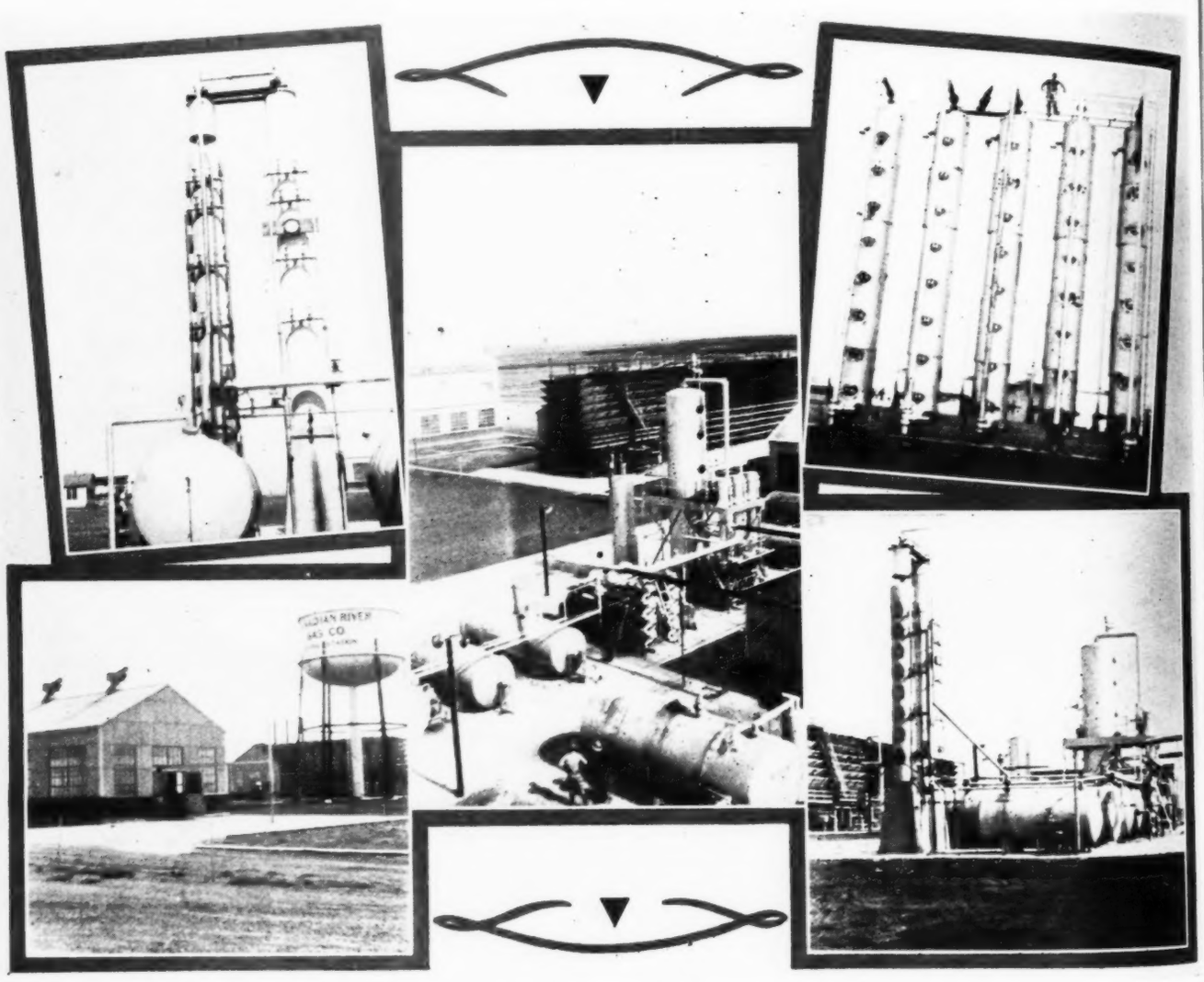
The gasoline is sweetened in a continuous treating plant using calcium hypochlorite as the reagent. The finished gasoline passes the doctor and corrosion tests.

The compressors take suction at 175 pounds and deliver the gas to the absorbers at 350 pounds pressure. There are five high-pressure absorption towers.

The steam is generated by means of three 125-horsepower tubular boilers. All of the condensate from the steam used in the plant is collected and used for boiler feed water. The plant water is obtained from three water wells about 285 feet deep.

Automatic control instruments are used whenever possible to effect the most efficient plant operation.

A well-equipped chemical and testing laboratory is maintained at the station for control and research work.

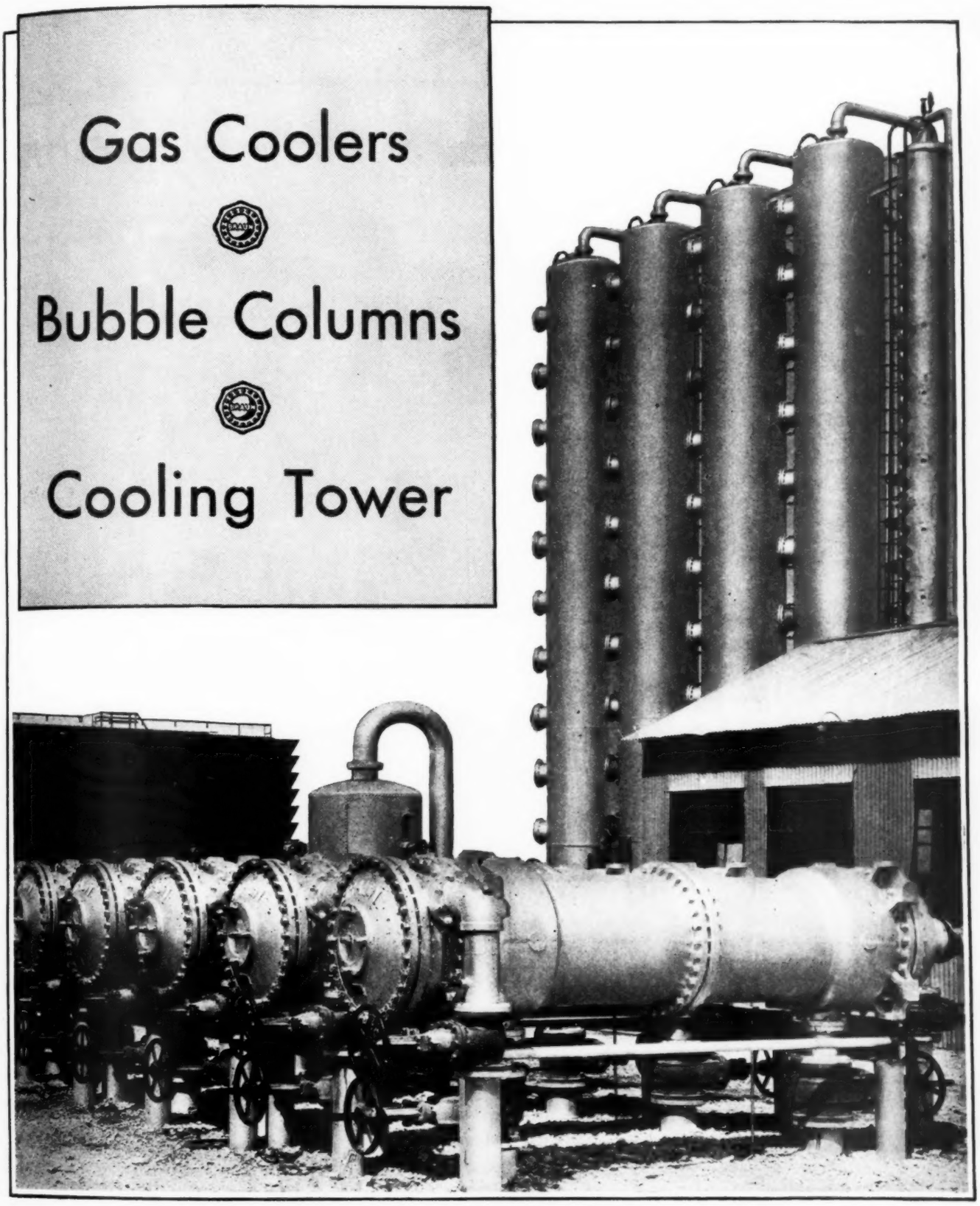


Views of Canadian River Gas Co.'s gasoline plant in the Texas Panhandle.
Top, left—Stabilizer. Center—Distillation unit and cooling tower. Top, right—Absorbers. Lower left—Water tower. Lower right—Side view of stabilizer.

Gas Coolers

Bubble Columns

Cooling Tower



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*Safe Methods in Use of*

# Explosives for Pipe Line Construction

*By* A. L. NIXON[1]

THE pipe line company or contractor using explosives and the manufacturer of explosives have two aims in common. They desire respectively to buy and sell the explosive that will give the best results in a given operation with the minimum cost, and they both desire that this explosive shall be used in the most efficient and safest manner.

Only by the accomplishment of these two aims can the interests of either consumer or manufacturer be permanently advanced. It is for this reason that the manufacturer does not confine his sales efforts to calls upon purchasing agents, but maintains a staff of technically trained men with expert knowledge of the many conditions affecting the use of explosives in the various kinds of blasting operations and offers the service of these men to explosive consumers.

For this reason, the Du Pont Co. during the early part of 1929 assigned a representative to the pipe line industry with instructions to develop a safer and more economical system of shooting for this class of work.

Up to this time very few pipe line builders were using electric blasting caps. Some had tried them and found that considerable grief was experienced in setting them off and that when they did go, they caved the banks, causing additional work in moving dirt, otherwise unnecessary.

Fuse and caps were generally used on most jobs. Three types of dynamite were the extent of their consumption. Most pipe liners used 40 per cent ammonia dynamite and if the material to be blasted was hard, 60 per cent was used.

Around 200 of the 8,000 grades, kinds and sizes of explosives manufactured by the company, may be successfully used on pipe line construction work under the varying conditions found in the United States. Consequently the problem was reduced to one of selection of the proper explosive for the particular work being done by the pipe liner.

Pipe line right-of-way shooting was entirely different than any other class of construction work. To properly service this type of work with the view to lowering costs and promoting safety, entirely new systems had to be worked out, and in this connection several important features developed, among which are:

Importance of proper selection of explosive.
Wisely chosen method of drilling holes.
Proper spacing of shot holes.
Proper depth of shot holes.
Care of loading and tamping holes.

Unless these factors were carefully observed the blast would not produce the breakage that should be expected and an undue amount of subsequent drilling and blasting would be required to satisfactorily complete the job. This condition, of course, added greatly to the cost of handling rock, especially with modern methods of moving blasted rock with mechanical equipment.

One of the first steps was to get users of explosives to

[1] Pipe Line Representative, E. I. du Pont de Nemours & Co.

Pipe lining through rocky country.

use electric blasting caps in place of fuse and caps. The system used on most pipe line jobs for lighting and shooting with fuse was very dangerous, not only to the men doing the work but for those who were required to dig out the material after the shot.

The shooter usually would load from 50 to 75 holes, then notch a piece of fuse to light with and start lighting the holes as he walked down the ditch. Sometimes there would be holes with fuse that would not light readily and the shooter either lingered to light it or would skip it. A number of shooters often are still lighting when the first shots start to go off, and there are numerous records of serious accidents which have happened as a result of this practice.

In one instance, a shooter went back to light a shot which he thought he had skipped, and it went off in his face blinding him for life.

There are records of many accidents where a workman's pick, coming in contact with a cap in a "missed" hole has caused the charge to go off, taking a toll of life and doing considerable damage to property.

With the use of an instrument known as a galvanometer electric blasting cap shooting can be made 100 per cent safe, and misfires can be made a very rare occurrence. The galvanometer consists of a pocket-sized metal case which contains a small chloride of silver dry cell connected with two binding posts by coils of wire, and a magnetic needle which moves across a scale in the face when a circuit between the binding post is complete.

To test a blasting circuit, the two end wires are contacted to the binding posts of the galvanometer. If the circuit is open the electric current from the galvanometer cell will flash through it and deflect the needle. If the circuit is broken, the needle will fail to move. The question is sometimes asked whether there is not some danger from connecting the wires from a loaded hole with the galvanometer and exploding the shot prematurely. We believe that we can safely say "No" to this question. The current generated by the silver chloride dry cell in the galvanometer, never very strong, is diminished by the galvanometer coils until the current which actually flows from the instrument is less than one-tenth of that required to fire a single electric blasting cap. We do not know of a single instance in which the galvanometer test has fired an electric blasting cap. It is important, however, that a worn-out galvanometer cell should be replaced with the same type of silver chloride cell.

It is recommended that the shooter test the electric caps before and after loading the holes. This test will detect trouble with a cap as soon as it arises and enable the blaster to assure himself before connecting the wires that all the electric blasting caps in the shot are in condition to function properly.

If the leading wire has been used for some time it is a good practice to test it also. To test the leading wire, connect one end of each wire to the galvanometer and leave the other ends free. If the needle moves, there is a short circuit between the two wires, probably caused by a break somewhere in the insulation which permits the two bare wires to touch each other. To detect leakage to the ground from leading wire, connect one end of the wire to the galvanometer and ground the other end of the wire. If the needle shows current through the galvanometer the wire which was not purposely grounded is leaking.

After the shot is completely connected up, the shooter should test the ends of the leading wire before attaching them to his blasting machine. If the galvanometer does not show a complete circuit, he can then go back and test the hook-up and locate the break before ordering the men back out of range of the falling rock. This saves considerable time usually lost by having labor idle while the shooter is locating breaks, or if he is shooting with fuse the electric cap system saves the time of having to light part of the shot, then return after the first shot clears off to light some more. With electric caps, the shot is over with one push on the blasting machine.

A pipe line right-of-way through swamp regions.

One objection which most pipe liners had to old-time shooting methods was that they were too slow and enough holes could not be shot at one time. A special blasting machine was introduced, which, if operated properly, will shoot from 75 to 100 holes at one time. It weighs only 27 pounds and is easy to carry around on the job. Some pipe liners believe that a blasting machine has to be recharged occasionally. The principle of this type blasting machine is simple. By means of gears, the muscular energy of the operator is made to revolve an armature in a small generator, thus producing electric current for firing the caps. Caps should always be connected in series if shot with a blasting machine.

Perhaps no single step in the preparation of a shot is of greater importance for efficiency and safety, than tamping of the holes. Proper tamping aids an explosive to detonate completely with resultant maximum execution. Proper tamping also prevents the dangerous practice of short fusing and goes far towards eliminating blow-out shots, which usually scatter rocks and cause damage.

The principal reason for urging pipe line companies and contractors to use electric blasting caps was to promote safety and overcome some of the hazards connected with fuse shooting. It also developed that by using electric caps the expense of drilling many extra holes per mile was saved by choosing a type of dynamite that would give the greatest shattering effect in the class of material to be blasted. This allowed for drilling the holes from six to 24 inches further apart than if shot with fuse and caps. Not only was the cost of dynamite and electric caps that would have otherwise been put in closer spaced holes saved, but it was found less dynamite was required in the holes that were shot.

A ditch in West Texas.

Bucking wrenches near the New Mexico line.

For example one construction job had been averaging three sticks of 40 per cent ammonia dynamite per hole spaced 24 inches apart. All shooting was done with fuse and caps. Of this particular project there was 21 miles of solid rock to make a 24-inch trench in. Following several serious accidents another system of shooting was attempted. Under the second system the holes were drilled 36 inches apart, the type of dynamite was changed, only one stick was placed in each hole and electric caps were used. This change in shooting methods brought about a saving of approximately $9,000 in explosives and the savings from 880 less holes drilled per mile. On this same job 65,000 electric blasting caps were used in the ditch without a single accident or a "missed" hole.

Another example is one where the method of shooting was changed for a contractor and allowed the use of the ditching machines being used on the job. Originally it was planned to have the rock removed by laborers. A type of dynamite was used that gave perfect fragmentation at a saving of several hundred dollars per mile on explosives and the saving of drilling around 1,000 holes per mile. The ditching machine removed the rock without any trouble.

In another instance a method of shooting was worked out that permitted shooting ahead of the ditching machine. The method was not only safe so far as the safety of the ditching machine operator was concerned but it saved the contractor several hundred dollars in labor which the machine displaced. One of the features worked out in this connection was the system of front-side controls developed by the machine manufacturer to replace the rear controls.

Several other machines have been used successfully in rock after shooting, but each ditcher requires a different method of shooting. By selecting the proper explosive the ditcher could make easier work of removing the blasted material without many delays and expensive replacements.

The success of shooting in swamps is illustrated on a job where the contractor had 4,600 feet of swamp to cross with a 10-inch line. It was so bad that they could not move equipment across. By using 50 per cent ditching dynamite it was possible to make a good ditch 36 inches deep at a cost of 10 cents per foot on explosives. This type of dynamite is so sensitive that it will propagate at from 18 to 24 inches depending on the amount of the charge. One man made the holes with an iron bar and the shooter followed, placing two sticks of dynamite to the hole. A cap is placed in one of the holes with a stick of dynamite. When this hole goes off the force of the explosion carries to the next hole and then from one hole to the next exploding all holes simultaneously. This system makes a good ditch but it throws the dirt high in the air and as it falls it spreads over the surface leaving very little left for back filling, however, in this case river clamps were put on the pipe as it was lowered in the ditch, and in due time the ditch will fill itself.

An article on safe methods and economical explosives for pipe line construction could be an endless one because each construction job is a problem in itself. What you work out on one job may not work out on the next.

The most satisfactory results are obtained when the pipe line contractor turns his explosive problems over to the explosive service man, then the most economical explosive and safest method of shooting is assured.

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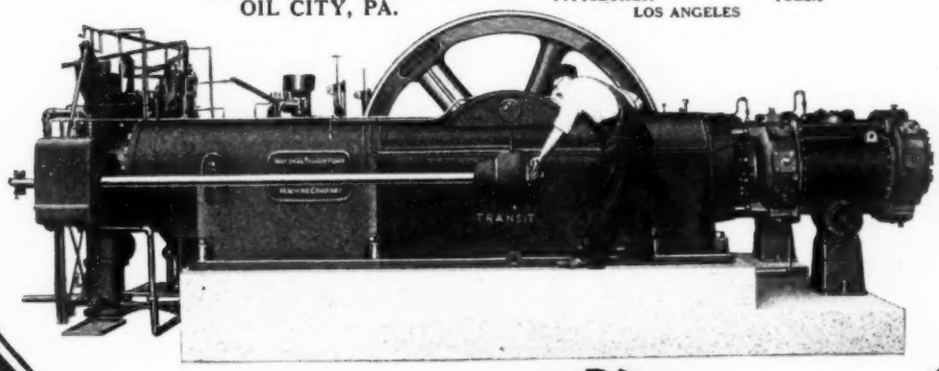


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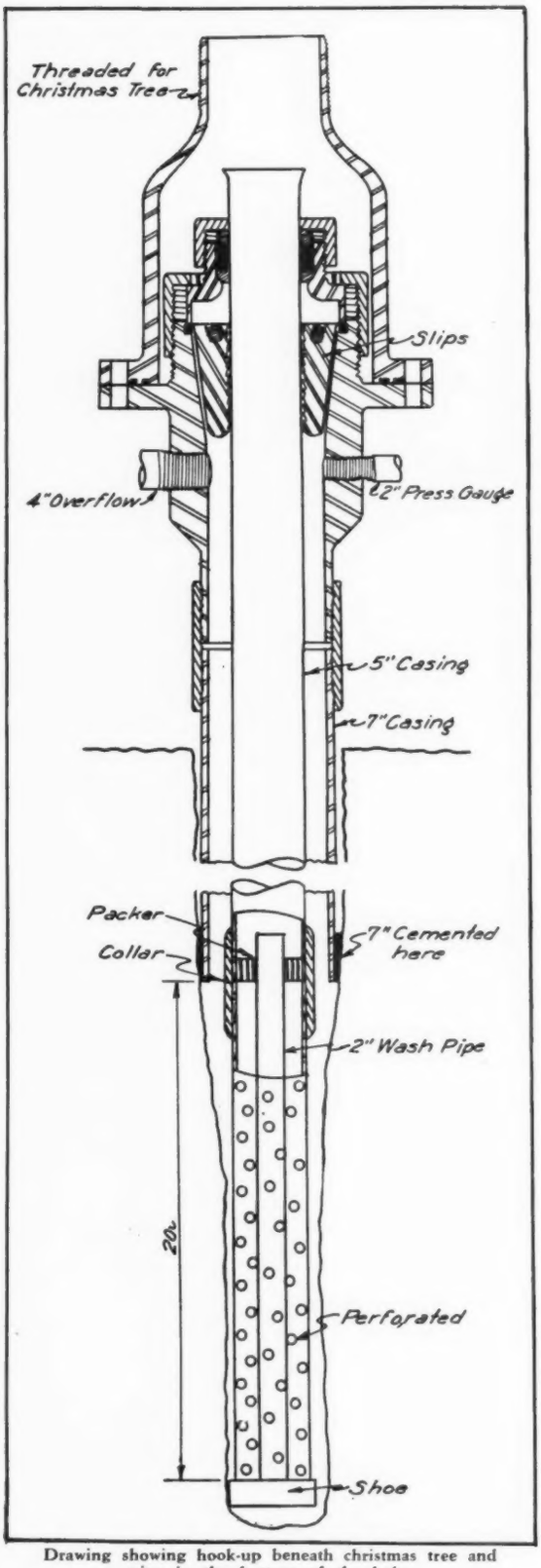
# *New Method of*

# "Washing In" High Pressure Wells




Drawing showing hook-up beneath christmas tree and pipe in the bottom of the hole.

RECENT experiments by operators in the Oklahoma City field have proven two very important things: First, that the enormous wells in high-pressure territory of the field can be completed under control; and, second, that the oil and gas ratio can be governed.

The first accomplishment means that the hazardous method of permitting the wells to blow oil and gas up in the air, carrying destructive sand through the connections, thereby damaging and endangering city life and property, as well as possibly injuring the fittings until they cannot control the flow, can be eliminated. The ability to govern the oil-gas ratio means the elimination of the present waste in completing wells by the blowing method, heretofore prevalent in the field. The last should mean a longer life to the field, if adopted generally, because of less injury to the producing formation.

These two very important realizations came with the successful completion of the Indian Territory Illuminating Oil Company's Trosper 1 by the use of the "washing in" method, which at all times, during the period of finishing, kept the flow of oil from the well under perfect control. So quiet and nonspectacular was the completion of this well that men in the nearby machine shops, supply houses and drilling wells in the congested district, went about their business, not knowing that a well was being completed. The "blowing in" method, whereby a well was permitted to clean itself under its own pressure, has been visible for several miles and always resulted in a shut-down of work in the vicinity.

The process is a simple one. Stated simply, it involves the replacing of the rotary mud with water by circulation. This is continued until the column is light enough to gas up and the well commences to flow. It is slightly more expensive to connect up a well for the "washing in" completion method than the blowing in, but if it should save a wild one, such as has been frequent at Oklahoma City, and also some damages, it well justifies the extra expense, according to engineers of the Indian Territory Illuminating Oil Company, who were responsible for the trying of the "washing in" method. This method has been used in California and also in the Gulf Coast with success, but this is the first time it has been used in any Mid-Continent oil field. An extra string of casing is necessary, and additional fittings in the cellar and Christmas tree, and several hours more in the bringing-in process.

This well set the regular string of seven-inch pipe, but inside of this was an extra string—a string of five-inch casing. The last two hundred feet of the five-inch was perforated, in which there were several thousand holes, three-eighths inch in diameter. Where the perforation commenced on the five-inch a two-inch pipe, termed the wash pipe, extended down to the bottom, where a shoe was attached. Packing was set around the top of the two-inch wash pipe. The top of the five-inch casing was suspended through a control head. Above this control head the casing was extended to the Christmas tree hook-up that included some extra valves for safety.

The process of washing in consisted of pouring, under pressure, of fresh water through the top valve, through the five-inch casing and out through the wash pipe to the bottom of the hole. This water carried with it the rotary mud back to the surface as it came in the seven-inch casing. A four-inch outlet from the control head carried this flow to the slush pond. It is advisable to keep the rotary mud in a circulating stage to prevent setting, or otherwise the water

# Its Record of Service is Unsurpassed

The Summerland field showing piers built to drill and pump shallow wells.
Photo courtesy National Petroleum News.

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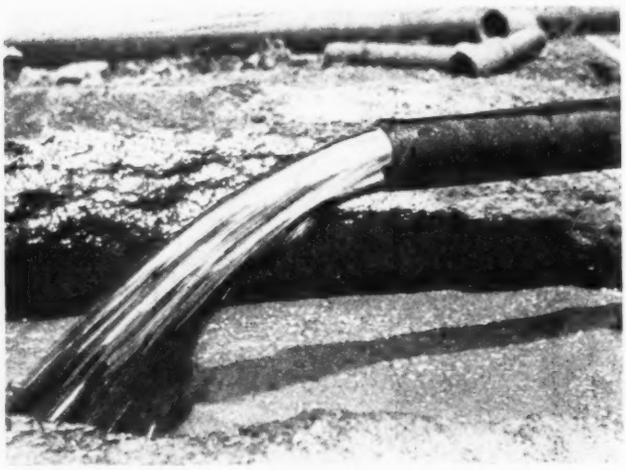
might channel and not thoroughly clean the hole. This was successfully accomplished in the Trosper 1.

After washing the mud out the water circulation was continued for some time to make sure that the hole was cleaned. At this time a spear was sent down and brought the two-inch wash pipe and packing out. Water circulation was continued again, now going out into the hole through the perforations in the bottom of the five-inch string of casing. The well refused to flow, because of lack of pressure to lift the water, despite the raising of the water level. Bailing was commenced and after lowering the water about 1100 feet from the top of the ground it could not be lowered farther. After gas commenced to bubble through the water, bailing was discontinued. The flow lines to the separators were prepared with the line to the slush pond and other outside outlets closed. The flow of oil and water came through the separators, with the water soon exhausted.

The perforated pipe in the bottom of the hole permitted the entrance of the oil, and still kept back much of the sand, which could not muster its cutting force in the bottom of the hole, like it does when permitted to travel at a rapid speed the mile and one-quarter to the top of the surface.

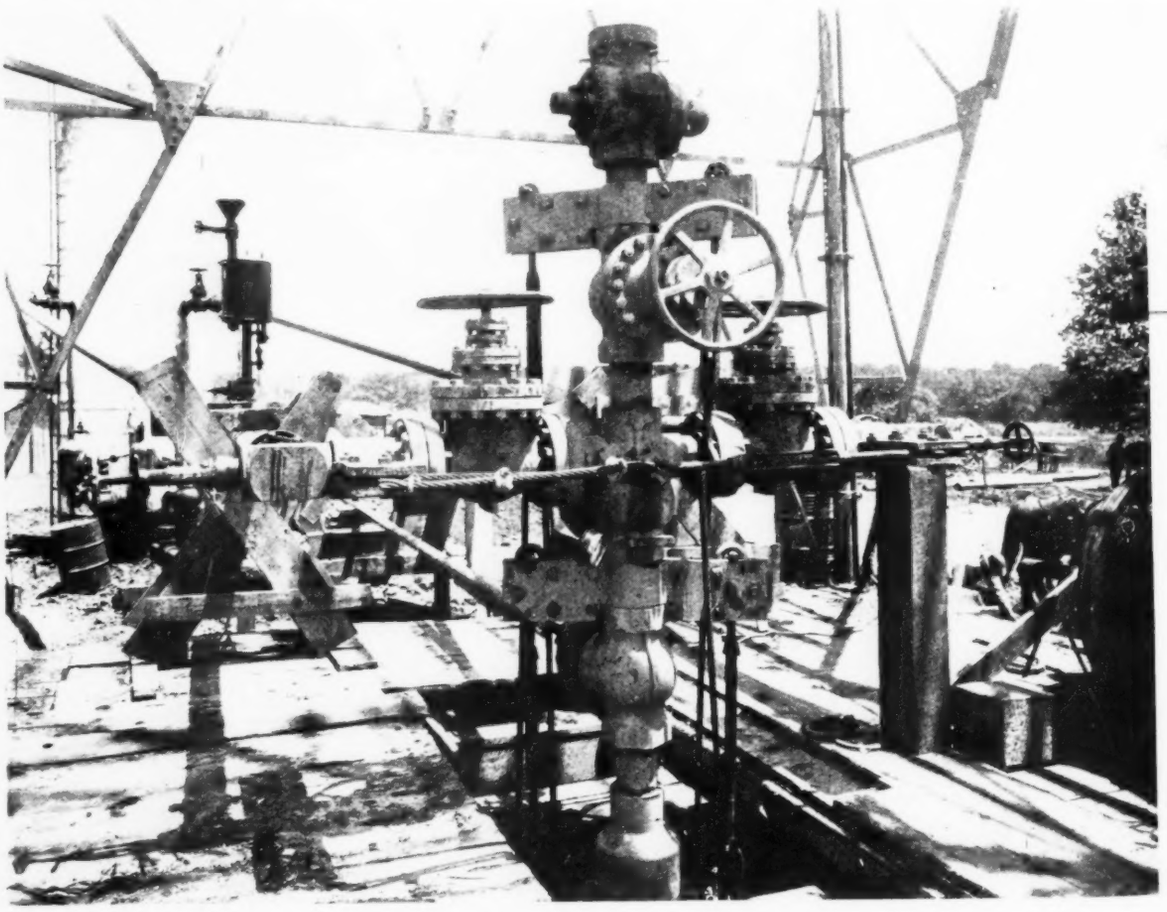


**The mud fluid flowing into the pits.**

Officials of many leading oil companies, as well as city and county officials, witnessed the completion of the well, and all others displayed considerable interest in the results, since it has become apparent with the town-lot drilling nearing heavier congested areas that some such safe method must be adopted.

Most of the operators in the Oklahoma City field are now trying to safeguard against undue hazards by equipping their tests with elaborate safety equipment. At the same time the Trosper 1 was being completed a good example of the need of safety equipment was demonstrated in the Phillips Petroleum Company's Traders Compress 1, in the extreme north end of the field, which adjoins the cotton compress. While drilling at 5905 feet in sand and lime the drilling mud was suddenly hurled from the hole. It is believed that it was not heavy enough to withstand the gas pressure, but due to the previous installation of a heavy control gate in the cellar the crew was able to quickly shut the flow in without damage, or disruption of nearby work.

While the Trosper well was bailed down until the water weight was light enough to permit the raising of the fluid column by the gas pressure, this method is not necessary.



**Christmas tree hook-up on I. T. I. O. Trosper 1, first well in the Mid-Continent brought in by the "washing in" method.**

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# Manion Station Is Model Unit

THE value of shaping existing conditions at a pipe line station to approach near the ideal from an operating standpoint, selection of a skilled crew and a close check and supervision on operation with the view toward increasing efficiency and lowering costs, is demonstrated at the Sinclair Pipe Line Co.'s Manion station. It is a main line station and its construction and operation varies little from that of other main line stations on the company's system.

Station officials and engineers are usually men coming up from the ranks and with a thorough knowledge of their problems. Daily inspections are made of machinery for minor troubles. Periodically units are taken down for a more rigid inspection at which time liner wear is measured, crank shaft alignment checked and, in short, the entire unit is gone over. Between periodical inspections traveling machinists visit the station and officials and engineers make frequent visits to the pumping plants.

Manion station is one of the most attractive of the main line stations and the pride which turned an otherwise unattractive site into one of attractiveness is one that reflects the pride taken inside the station. The station is located at the base of a slow rolling slope in the somewhat famed hills of Osage county and near the town of Hominy, Okla. It is a 160,000-barrel capacity Diesel powered plant.

Corresponding to typical Sinclair main line station construction it was built with concrete, steel, brick and tile. The roof is made of corrugated asbestos. The interior walls are tile and the outside walls are paneled with concrete and finished with red brick to add to the station's attractiveness.

The concrete floors are painted battleship gray, the walls white, and the roof gray. This, along with the ample lighting space in the walls, gives an improved interior lighting. The engines, too, are periodically painted, free of oil leaks, and all brass parts on the older installations are polished daily.

Manion station's five engines, driving as many horizontal reciprocating pumps, have a combined rated capacity of 2,240 horse power. The largest of the units is two 750 horse power vertical engines, directly connected to 50,000-barrel capacity horizontal triplex pumps.

These engines are usually operated at an average speed of 165 r. p. m. and the gear ratio to the pumps is 3.8 to 1. The engines have a rated speed of 180 r. p. m., which permits a good margin of reserve power when they are operated at their average speed.

Another unit of the same make is in operation at the station. It is a 440-horse power V. E. type, directly connected to a 33,000-barrel capacity triplex pump. Its average operating speed is 200 r. p. m. and has a rated speed of 225 r. p. m. The gear ratio is 4.8 to 1.

The other two engines are each 250 horse power. One is a horizontal engine, driving a 14,000-barrel pump. The engine's average operating speed is 160 r. p. m., and the gear ratio is 4.727 to 1. The other unit is a vertical engine, operated at a speed of 240 r. p. m., and has a rated top speed of 256 r. p. m. The gear ratio is 7 to 1.

**Top to bottom—One of the 50,000-barrel Triplex pumps equipped with air bottles. One of the 750-H. P. oil engines. Office building and heating plant. Station water tank with lube oil storage tank directly beneath it and air tanks on ground level.**

# *in* Sinclair Pipe Line System

One of the features in connection with the operation of the station is the electric power generating units. In the station there is only one generator. It is a 40 K. W. machine set up between the two big engines, and may be driven by belt from either engine.

One or both of these units is in operation constantly, and consequently only the one generator was installed. The belts used to drive the machines are reeled in on a drum over the pulley on the shaft of the unit that is down. In this way belting troubles have been reduced to a minimum. Generator failure from any cause in the main station is amply cared for by an unusual installation in the auxiliary building.

All of the lubricating oil is handled by passing it through a series of settling tanks and filters, and it is interesting to note that each container is a cone bottom tank. Oil from the crank case gravities into a settling basin and from there it goes through three filters connected in series.

Entering the first filter tank at the bottom the oil fills to the top and gravitates out through a connection on the back of the tank, which delivers it into the bottom of the second tank. This process is repeated to the third tank, where the oil gravitates from a connection near the top of the first of two settling tanks below the floor level.

These tanks are connected in series, and the gravity line leading from the filters to the settling tank goes down into the settling tank at the junction of the cylindrical part with the cone. Near the top of the tank is a connection for another gravity line going into the second tank in the same manner as used for the first tank. When the first tank fills it flows over into the second. A swing suction line is suspended in the second tank and a pump picks up the clean oil and discharges it into the overhead working tanks.

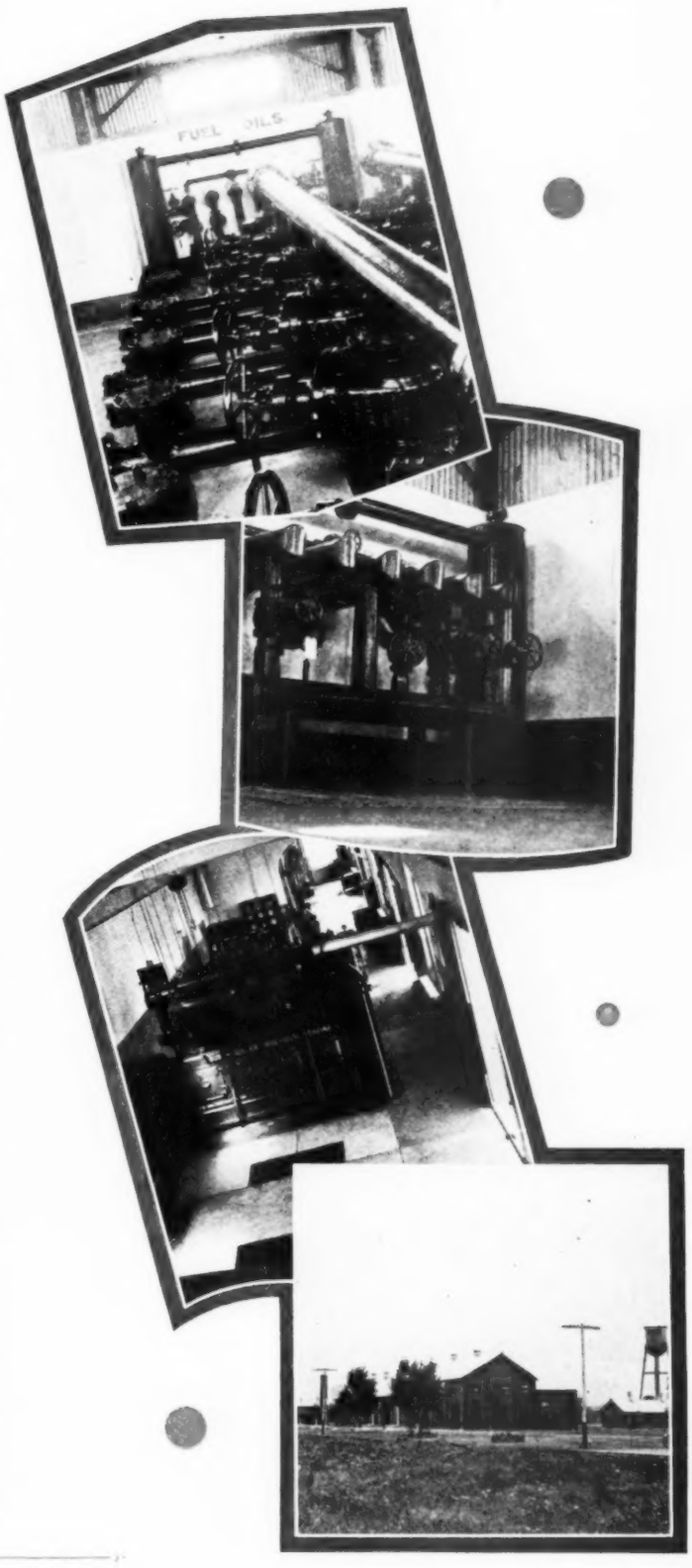
Both of the two settling tanks are equipped with clean-out lines, which extend down through the center to near the bottom. Periodically, a suction pump is connected to the lines and these tanks cleaned.

The overhead tanks are also cone bottom cleaners and have a connection on the bottom for cleaning. The line running to the engines enters the tank approximately 18 inches from the bottom. Periodically, the oil is drained from the bottom of the cone bottoms and saved. It is batched, along with other oil, through a reclaimer or centrifuge later on.

By the time the lubricating oil completes its course through the filters and settling tanks it has lost much of the heat it carried when leaving the engine. At the time it reaches the overhead tank its temperature has been reduced to a little over 100 degrees.

This method, along with careful and periodical engine inspections, has prolonged the life of oil and machinery. The inspections serve as a correction chart for any mechanical troubles which may permit excessive use of oil or reduce efficiency. It is station practice to remove the settlings in crank case bottoms whenever an engine is shut down. By doing this, much of the dirt is removed that would otherwise have to be removed by the filters and settling tanks.

On the main lines traveling machinists make periodical visits to the stations in their district. Upon the machinist's



**Top to bottom—Fuel manifold. Close-up view of fuel oil manifold, showing settling tanks on side and at bottom. Interior of station with 250-H. P. engine in foreground. General view of station.**

arrival the periodical inspections are started. Records are taken in detail of each inspection in order that comparisons may be made.

Every four months the big engines are shut down and the piston pulled. At that time the liner wear is checked, rings inspected and the piston cleaned. On the smaller engines this inspection is less frequent, because they are not operated as much as the larger units.

Another important inspection is of the crank shaft, which is made every six months. The shaft is checked for alignment and corrected to .001 of an inch. This practice has resulted in the reduction of expensive crank shaft trouble and, of course, in better operating efficiency. Careful consideration of this point starts with the installation of a unit; after the foundation is ready, the bed plates are leveled, grouted in, and then the crank shaft is installed and put in alignment.

On the larger engines the valves are ground every nine months. Fuel pump and spray valves are ground every 60 to 90 days. This work is all done by hand at the station because there is comparatively little of it to be done.

A novel system of handling the fuel oil is used at this station. A small manifold has been built in the discharge manifold house to divert the streams of fuel oil into different oil lines. A 22 to 26 gravity fuel is burned because a cleaner and more satisfactory fuel is obtained.

Fuel is shipped to the station in tank cars. A rail line passes directly by the station and a siding has been put in for unloading material. The oil is pumped from the cars direct to the fuel storage tank and later pumped to the fuel working tank. With the use of the manifold the fuel oil stream can be directed to any of the station lines, and in case of fire in the tanks or engine room the lines may be cut out. The oil from the pumps which drains into a sump is also pumped out and into the storage tank through the manifold. By the use of this system of handling fuel, foreign material which may get into it in transit or otherwise has a chance to settle out. At the manifold it goes through two tanks, one on the suction side and the other on the discharge side. By storing a large quantity in the fuel supply tank fuel has time for additional settling.

Water for station use as well as for domestic use at the cottages is obtained from a spring three miles distant from the site, and flows to the treating tanks by gravity. The water has to be treated for hardness and requires approximately one and three-quarters pounds of chemical per 1,000 gallons of water.

An automatically controlled motor-driven water pump is employed to keep the cottage water tank at a desired level. When a 40-pound pressure is built up in the discharge line the automatic control actuated by the pressure cuts off the power to the motor. When pressure in the discharge line is lowered to 20 pounds the same device closes the switch, which starts the motor. A check valve is located on the gravity line leading into the treating tanks and prevents treated water from going into the cottage water tank.

The station is well equipped with fire fighting equipment, in addition to the numerous water connections for both the station and cottages. In the station are three 40-gallon foam engines with hose, and located in convenient places are six two and one-half-gallon hand extinguishers. The hose equipment consists of two 300-foot reels of two and one-half-inch hose.

The office building is of brick construction and also houses the low pressure heating plant. The latter is comprised of two low pressure boilers. On the same floor are the locker and shower rooms for the station crew. On the second floor the telegraph, district superintendent and other offices are located.

Both the suction and discharge manifolds are rigidly connected and designed to permit ample freedom of movement for the workmen to tighten flanges or repair valves. They also are kept in a tidy condition, are free of oil leaks, and are well drained.

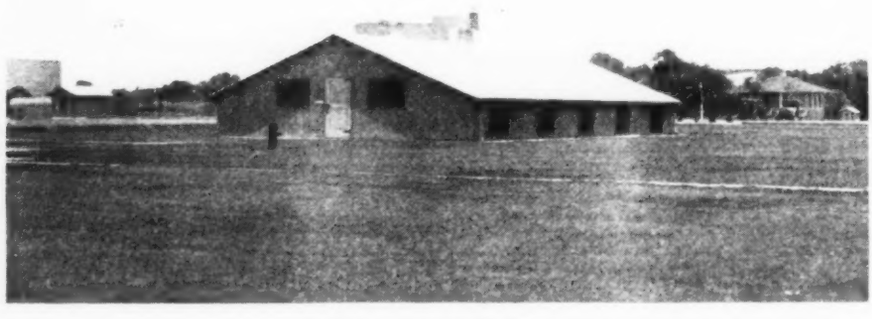
Only minor repairs are made at the station, and virtually all of this work is done on the half-story over the office and shower room on the engine room side of the station. In this space virtually all of the station's small tools and spare parts are stored. Whatever repair work can be done is usually accomplished on the work bench in this section of the station. All of the more important repair jobs are sent to the company's Tulsa shops.

The auxiliary plant is so designed that it is next to impossible for the plant to be without lights and power for the small motors. The equipment in the building consists of two vertical engines, one generator, a combination generator or motor, and three pumps.

These two engines, operated singly, drive through a line shaft mounted on pedestal bearings and extending through the building. The first unit has a combination generator so wound that if necessary it may be operated as a motor to drive the line shaft or be used as a generator. The second unit is directly connected to a generator.

The two smaller pumps are used to handle water in emergencies and fuel oil, one for each service. The third pump is a 10 by 18 suction pump. A small auxiliary air compressor is also located in this building.

By having the unusual power generating layout in the auxiliary building the first engine can be used to drive the line shaft and generator. If that engine should fail, No. 2 unit could be started and its generator could be used to produce power for the combination generator on No. 1 unit, which in that event would serve as a motor driving the line shaft. Thus it would take something like a calamity to keep Manion station from having lights and electricity to power auxiliary motors.



Discharge manifold house.

# THE ANSWER

## to the Oil Industry's Demand for the Best

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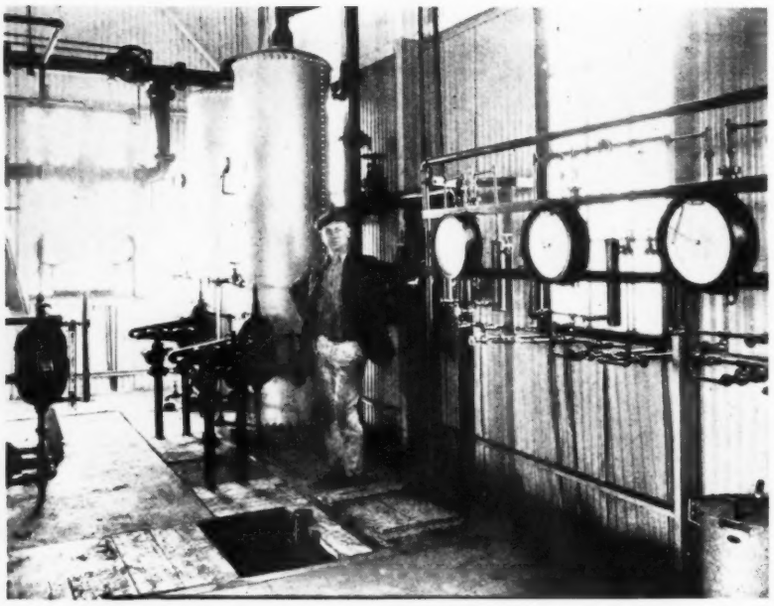
# PROPER Location *of* Metering Facilities *in* GASOLINE PLANTS[1]

*By* E. H. PANN[2] *and* W. M. YOUNG[3]



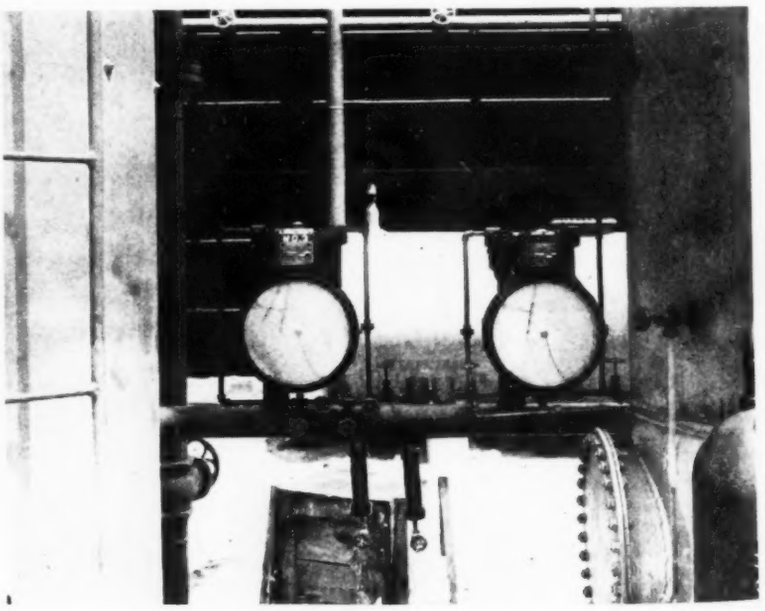
Metering equipment at a California plant.

UNTIL recently natural gasoline plant operations were governed to a great extent by the amount of gasoline that the plant could produce; that is to say, the manufacturer was not confronted with the need to control plant operation except as the exercise of such control might have been required to extract gasoline in quantity, without very much thought being given to quality. Even then efficient plant operation required the measurement of gas and liquid volumes.

Today the manufacturer of natural gasoline is continually confronted with the problem of not only extracting the maximum volume of a marketable product, but he must exercise control of plant operations to the extent that the final product run to storage will be salable under rigid marketing specifications. One of the prime requisites in the control of present-day plant operations is accurate knowledge of the performance of each unit of equipment. To the casual observer, a gasoline extraction plant has relatively few separate and distinct units of equipment; however, when a complete analysis of plant operations is made, the number of pieces of equipment that function as a unit of operations is quite large. When an operator starts to check the performance of his plant, he does not get very far in his investigation without the aid of measuring facilities. Without exception, his first questions are: How much gas, oil, steam, water, etc.? And unless each of these questions is answered with a certain degree of accuracy, his investigation will be valueless. It may even result in costly recommendations which may later prove unwarranted. Again, if he has not had the forethought to provide proper measuring facilities when the plant was first constructed, he either goes on operating by guess or calls in the measurement engineer and shifts the burden of lack of forethought to his shoulders. In such cases the measurement engineer usually receives instructions to make the installation immediately, do it as cheaply as possible, and, above all things, the installation must be made without a plant shutdown. This procedure cannot help but be costly, quite frequently dangerous, and, in the majority of cases, a waste of effort in so far as final results are concerned. It usually is the case that measuring devices installed as an afterthought cannot be made to function properly for lack of being able to reproduce conditions under which the particular measuring device was designed to operate.

All of the foregoing directs our attention to the one fact that provisions for the accurate measurement of gas, oil, water, steam, etc., should be incorporated in the design of the plant.

The intent of this article is not to point out the



Meters for measuring gas passing through absorbers in a gasoline plant.

[1] Prepared in conjunction with Metering Committee, California Natural Gas Association.
[2] El Camino Oil Co., Los Angeles, Calif.
[3] Texas Co., Los Angeles, Calif.

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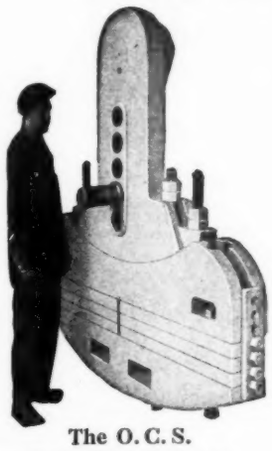

The O. C. S.
Crank Type Balance

O. C. S. Pumping
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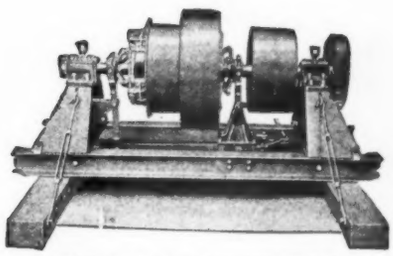
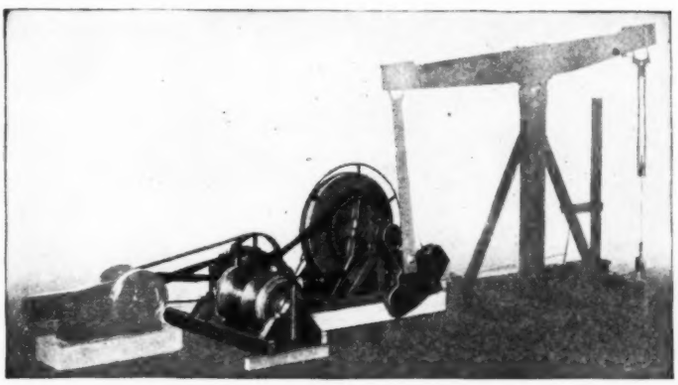


The O. C. S. Countershaft

With
TIMKEN
BEARINGS



For Gas Engine Power with O. C. S. Countershaft

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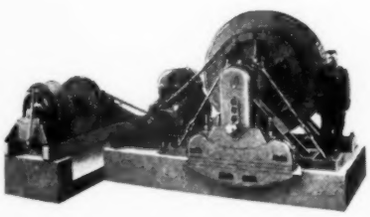
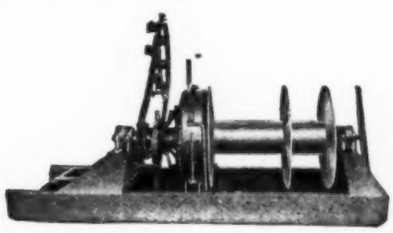
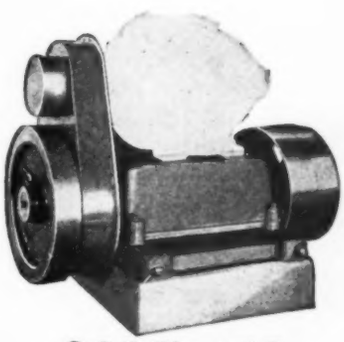


For Electric Power with
the O. C. S. Diamond T Unit



The O. C. S. Sand Reel



O. C. S. Diamond T
Reduction Unit

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details of each phase of plant measurements. All that is required of the designing engineer is to select the proper meter for the job and then arrange his installation so as to provide conditions of flow under which the meter is designed to operate. This may appear costly at the outset, but subsequent results will more than offset the original cost.

As a guide to the plant designer, the Association's metering committee has prepared the following chart on which is listed the commodities required to be measured and the various points of measurement generally applicable to natural gasoline absorption plant operations.

### *1. Gas*

A. Wet Gas
  1. Plant Intake Meter.
B. Dry Gas
  1. Plant Discharge Master Meter.
  2. Individual Absorber Discharge.
  3. Low Pressure Gas Return to Field.
  4. Low Pressure Sales.
  5. Low Pressure Surplus or Unconserved Gas.
  6. Low Pressure Engine Fuel.
  7. Low Pressure Boiler Fuel.
  8. High Pressure Sales.
  9. High Pressure Gas Lift and Repressuring.

### *2. Steam*

1. Steam Master Meter.
2. Agitation Steam to Still.
3. Steam to Preheater.
4. Steam to Reboiler Sections.

### *3. Gasoline*

1. Gasoline to Rectifier.
2. Reflux to Rectifier.
3. Reflux to Still.
4. Runs to and from Storage.

### *4. Gasoline Vapors*

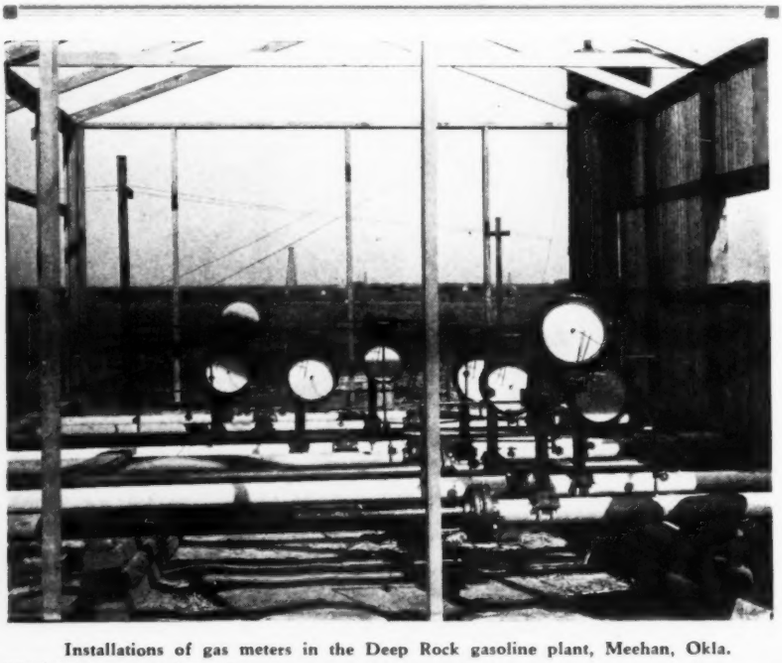
1. Plant Vapors to Recompressor Intake.
2. Uncondensed Vapors from Still.
3. Rectifier Overhead.

### *5. Oil*

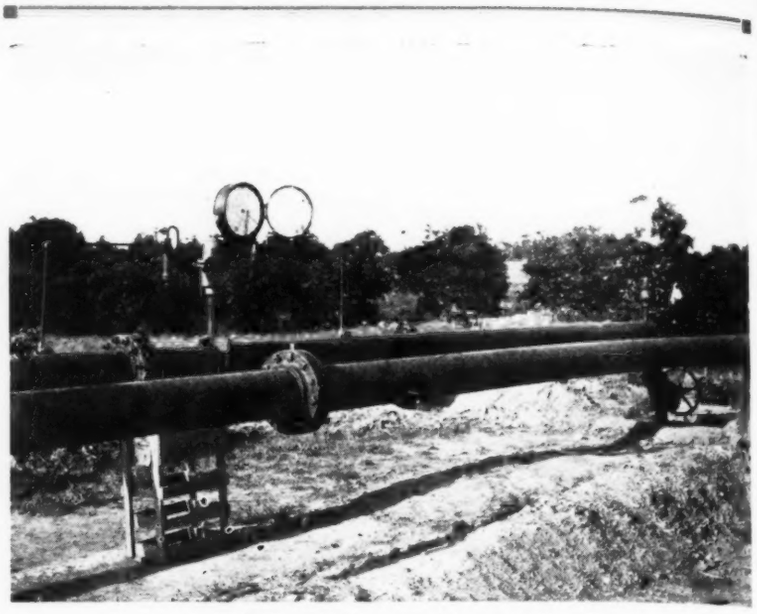
A. Lean Oil
  1. Master Meter . . . Total Circulated.
  2. Individual Absorber Intakes.
B. Enriched Oil
  None.

### *6. Water*

1. Master Meter.
2. Water Softener Throughput.
3. Boiler Feed.
4. Cooling Tower Make-up.
5. Volume over Coils in Cooling Tower.
6. Engine Jacket Water.
7. Condensate from Gasoline Water Separator.



Installations of gas meters in the Deep Rock gasoline plant, Meehan, Okla.



Meter installations on field gas lines.

### *Gas*

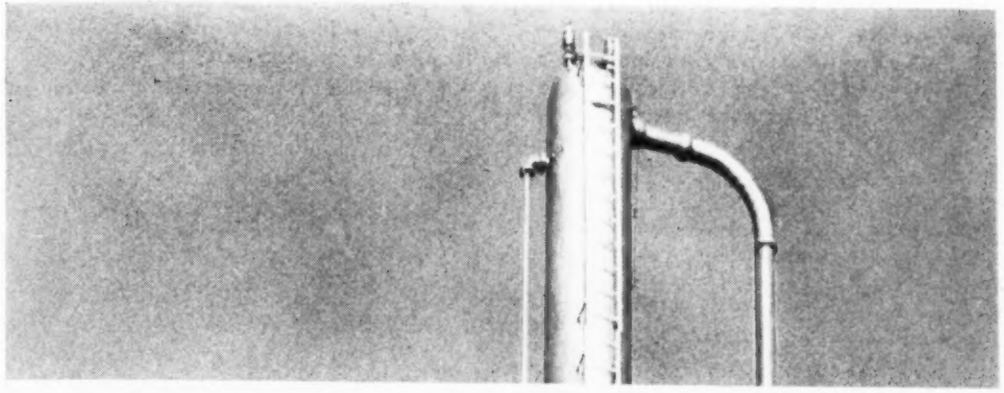
*Wet Gas*

(1) Measures the total volume of wet gas treated in the plant and serves to check the total amount of wet gas received through individual lease meters. The results of measurement obtained at this point govern almost every phase of plant operations. Conditions of measurement at the plant intake may involve pressure, vacuum or both. The intake meter is undoubtedly watched more closely by plant foremen and operators than any other meter. Care should therefore be taken to install these meters in a conspicuous place where operators can have ready access to them in their routine movements about the plant.

*Dry Gas*

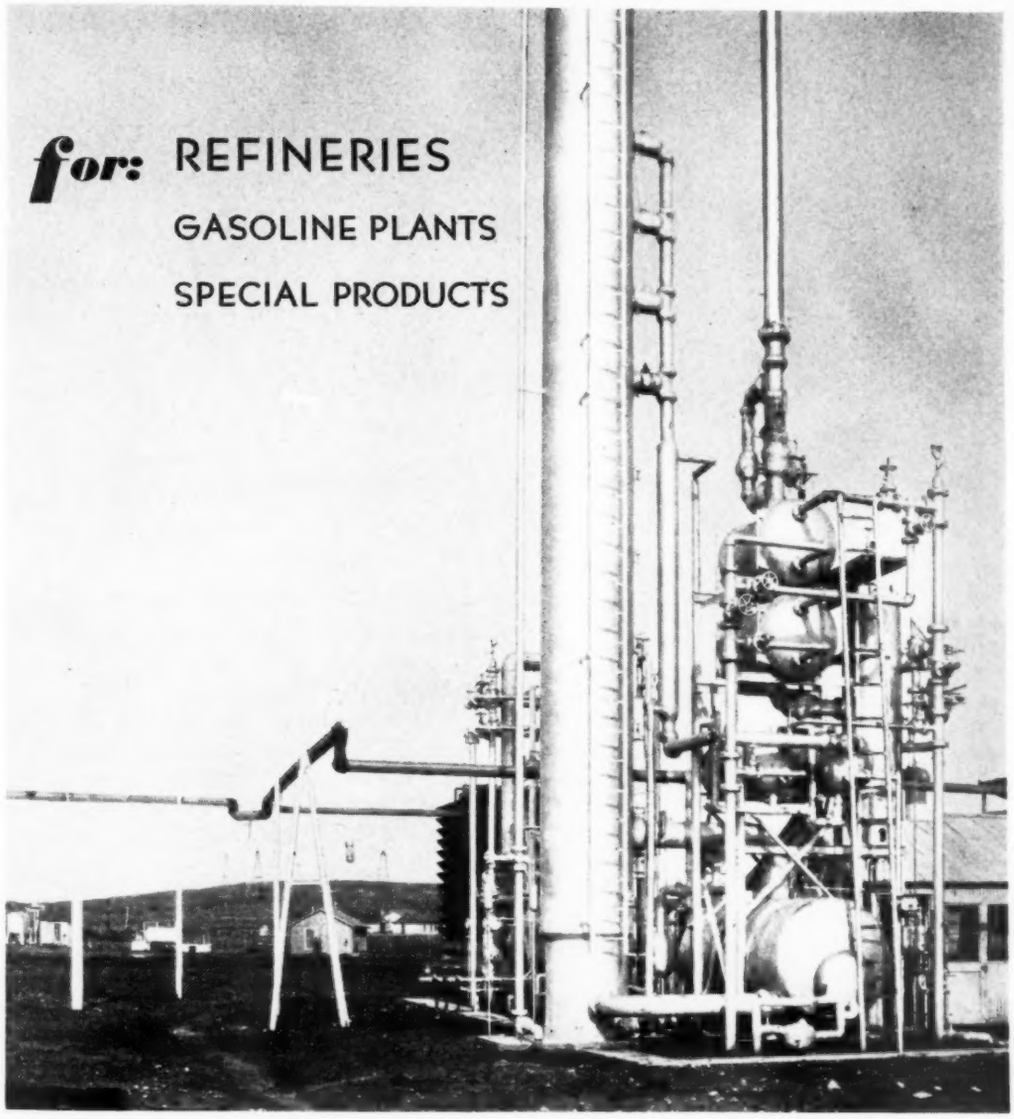
(1) The location of this meter should be such that the record obtained will represent the summation of dry gas meters (3) to (9), inclusive. The difference obtained by subtracting the record of this meter from that of wet gas (1) should represent the decrease in wet gas volume due to extraction of gasoline and other plant losses. This meter serves (a) for an immediate check upon plant losses due to line breaks or other happenings; (b) a positive discharge record, since the same is not subject to irregularities as much as are sales, blow-off and field requirements; (c) an immediate check on available dry gas factor. All of these latter-mentioned meters (3 to 5) are subject to irregularities as a result of wide variations in volumes, which are recorded only by frequent changes of orifice discs. Very few plant installations support a meter of this nature, but to one familiar with the great variations in flow met with on field fuel and surplus meters, the advantages are obvious.

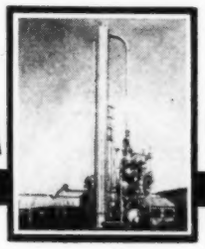
(2) The control of absorber operations requires knowledge of the volume of gas distributed to each individual absorber. Some means of indicating the volume to each unit is indispensable to obtain the proper distribution of the total gas. Close attention to the record of these meters is an important function of the



# FRACTIONATING UNITS

*for:* REFINERIES
GASOLINE PLANTS
SPECIAL PRODUCTS





**PETROLEUM ENGINEERING, INC.**

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plant operator's duties. They should, therefore, be located conspicuously in the routine paths of the operators.

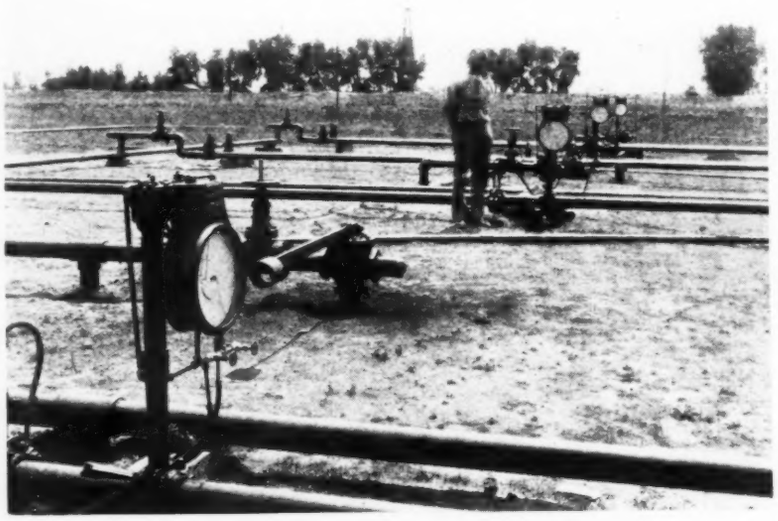
(3) to (7), inclusive, serve the purposes indicated and do not present any serious problems of measurement if properly located. Grouping these meters where possible in a common location serves to protect against the elements, cooling tower spray, etc., and facilitates changing charts and also aids in the observation of their records.

(8) and (9). Wherever practicable these meters should be located on the intake to the compression apparatus so as to avoid inaccuracies resulting from pulsation, high temperature, compressibility and many other difficulties met with in measuring gas as the discharge of a compression plant.

***Steam***

(1) This meter is desirable in order to obtain the steam output of the boiler plant as an aid in efficient boiler plant operation, in checking against record of feed water input and also as a means of checking steam distribution to the various pieces of equipment in the plant.

(2) The measurement of steam for agitation in the still is essential for consistent operation, and should be placed sufficiently close to the control valve so the reading may govern the setting of the valve by the operator. By its use the proper steam to oil ratio may be determined and the control made to conform to varying amounts of oil circulated. This same factor is sometimes calculated in terms of steam consumed for agitation per gallon of gasoline distilled from the enriched oil.



Meter installation at a natural gasoline plant.

(3) Provision should be made so the steam to preheater can be measured at such periods as the efficiencies of plant equipment are required.

(4) Plants using heating sections or reboilers in still and rectifiers should make the same provision for measurement as in (3).

The difference between steam (1) and the summation of steam 2, 3 and 4, in general represents the steam used in prime movers. Where exhaust steam is used for agitation, this would be represented by the difference between item (1) and summation of (3) and (4).

***Gasoline***

Use of fractionating stills and high-pressure rectifiers for gasoline is common present-day practice. Items 1, 2 and 3 cover gasoline measurement in connection with their use.

(1) A volumetric control meter on the gasoline stream is usually used to control automatically the speed of the feed pumps. The record of the volume of gasoline can be read in the same manner as with an ordinary orifice meter on liquid measurement.

(2) Refluxing over the rectifier is usually handled in either of two methods, i. e., constant rate control as (1), or constant temperature control. In the latter case a meter is required in addition to the control instrument to determine the volume being refluxed.

(3) The same may be said concerning this measurement as covered under (2).

(4) In gasoline production measurement, usually tank gauges suffice, although when more than one distillation unit operates into the same storage tank separate measurements may be found necessary on the different gasoline run streams. Due consideration should be given to locating this measuring equipment for accessibility.

*Gasoline Vapors*

(1) When vapors are collected from the plant system they are comingled and disposed of in various manners in accordance with company practice, such as

(a) to vacuum intake,

(b) to recompressor intake,

(c) to reabsorber direct at low pressures.

The measurement of vapors in total gives a day-to-day record of importance, whether the disposal is a, b or c. At best it is an aggravating part of operation to deal with these vapors, and whether disposal is a, b or c, measurement should be taken, as excellent information may be ascertained upon the absorber and still from the record. If method (a) is used, the measurement should be such that the connection is downstream of the intake meter.

(2) A record of measurement on uncondensed vapors from the still alone often gives desirable information upon its condensing equipment. Provision should at least be made for such measurement.

(3) Measurement upon overhead vapors from the rectifier is general, as the volume gives the basis for calculating the reflux ratio of the unit.

***Oil***

*Lean Oil*

(1) Where a number of absorbers are operating in parallel, a master meter within reading distance of the lean oil pump is important in setting the total oil to be circulated, as determined by the gas intake master meter reading.

(2) Balancing the oil load to each absorber is done in accordance with readings on individual absorber meters, and the meters should be as carefully located as dry gas meter item (2).

*Enriched Oil*

Attempts to measure this oil usually meet with disappointment. This is often due to the measurement of a liquid with entrained gas. After such readings are taken

the readings cannot be applied to any particular advantage, so this measurement is not considered essential.

***Water***

(1) This serves as an immediate check on all plant water used. In many plants water is a costly item, and unless the water company meter is near for frequent inspection, a further meter should be installed for observation by plant operator.

(2) This measurement is mostly for a matter of operations to obtain the cost of softening water.

(3) This gives a record of boiler plant consumption of water. With it a check may be obtained on the steam meter. (Steam, No. 1.)

(4) It is advisable to have a record of cooling tower makeup, particularly where water is an important item from an economic standpoint.

(5) An interesting and informative record is included in a measurement of water over the coils, and at least provision should be made for installation of a suitable metering device.

(6) A balance may here be made on temperatures of engine jackets and water used. A considerable saving can often be effected by such measurement.

(7) Measuring steam condensate from still is the method used in some plants for determining the amount of steam to be used with a given oil circulation.

Measurement is obtained in an absorption plant by devices as follows:

1. Orifice Meters.
2. Manometers.
3. Indicating Meters.
4. Displacement Meters.
5. Flow Controls.
6. Tank Strappings, etc.

Each has its place in measurement and the location of each should be carefully analyzed before installation and the equipment accorded sufficient space for proper operation and accessibility for those who must work on it. It is important to have sufficient points of measurement, whether or not the instruments are installed at the time the plant is constructed.

Insufficient consideration toward measurements has brought forth conditions as follows:

1. Short meter runs.
2. Lines run off meter runs.
3. Meter runs and orifice plate and fitting buried in ground.
4. Orifice flanges or fittings against a wall or other obstructions, making orifice plate changes difficult.
5. Orifice flanges or fittings in a hole or small box with same difficulties.
6. Pipe lines run over the top of the flange or fittings after the meter set-up was made.
7. Meter in spray of cooling towers.
8. Meter runs set in irregular places difficult of access.
9. Manometers placed in places where vibration makes reading impossible, and glass may be fractured in normal movement of operators about the plant.
10. Meter locations where leaks are hazardous from standpoint of fire, and surrounding equipment as electrical switches, magnetos, engine exhausts and steam pipes.
11. Meters required which cannot be put in without a plant shutdown, attendant by a considerable expense.

It is of utmost importance that the engineer in charge of measurement and the engineer in charge of plant operations be consulted in plant design for the proper locating of measuring devices. It involves upon those designing plants to consider well this phase of plant operation by making provision for a sufficiency of measurement at the time of plant erection.

For those plants already in operation it is necessary often to replace measuring devices, and when this is done consideration to the importance of the device should be given.

Satisfactory results can only be obtained when measuring equipment is installed in accordance with good measuring practices.

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## Modernizing Refinery Power Plants

THE power plant of a modern refinery is so much more economical and efficient than the power plant of ten years ago that the owners of old plants are becoming concerned about the state of affairs. They are wondering what can be done, if anything. Will it be necessary to start all over again and build a new power plant, or can the present plant be rehabilitated? In fact, can it be made better than it was when new, and capable of competing with modern plants? Certainly these are important questions.

My experience has been that in most instances the old plant, particularly the boiler plant, can be brought right up-to-date without great cost. In some instances it can be made better than certain so-called modern plants. And, what is of prime importance, the cost of the modernization will be considerably less than would be the cost of a new plant. As stated by one authority:

> "The vast majority of plants built ten years ago can be reconstructed to produce astonishing savings in power costs. In addition to this fact, there has come about a very logical policy of inter-connection between utility and manufacturing plants, whereby it is to the advantage of both parties to work out the most economical local power supply on a co-operative basis."

It must be obvious to any thinking person that heat will pass through an old boiler plate and tube as readily as it will pass through a new plate, provided the plate is kept clean. As a matter of fact, there should be a slight improvement with age because boiler plates and tubes usually become slightly thinner. The boiler whose heating surface does not change with age is a rarity.

Therefore, arrange to keep the tubes perfectly clean inside and out. The modern method is to keep boiler water so pure that no scale will be deposited. Or, install a deconcentrator. By installing a soot cleaner all ash and soot may be kept off the outside of the tubes.

Combustion efficiency can almost invariably be improved by increasing furnace volume. This is accomplished by installing modern boiler baffle walls and sometimes modern furnace lining. There must be no air leakage through boiler baffle walls. And there must be no heat leakage through the outside boiler walls. Proper baffle wall design will give the correct gas velocity through the passages of the boiler. There will be no slagging. Flexible joints are advisable so that there will be no cracking or breaking.

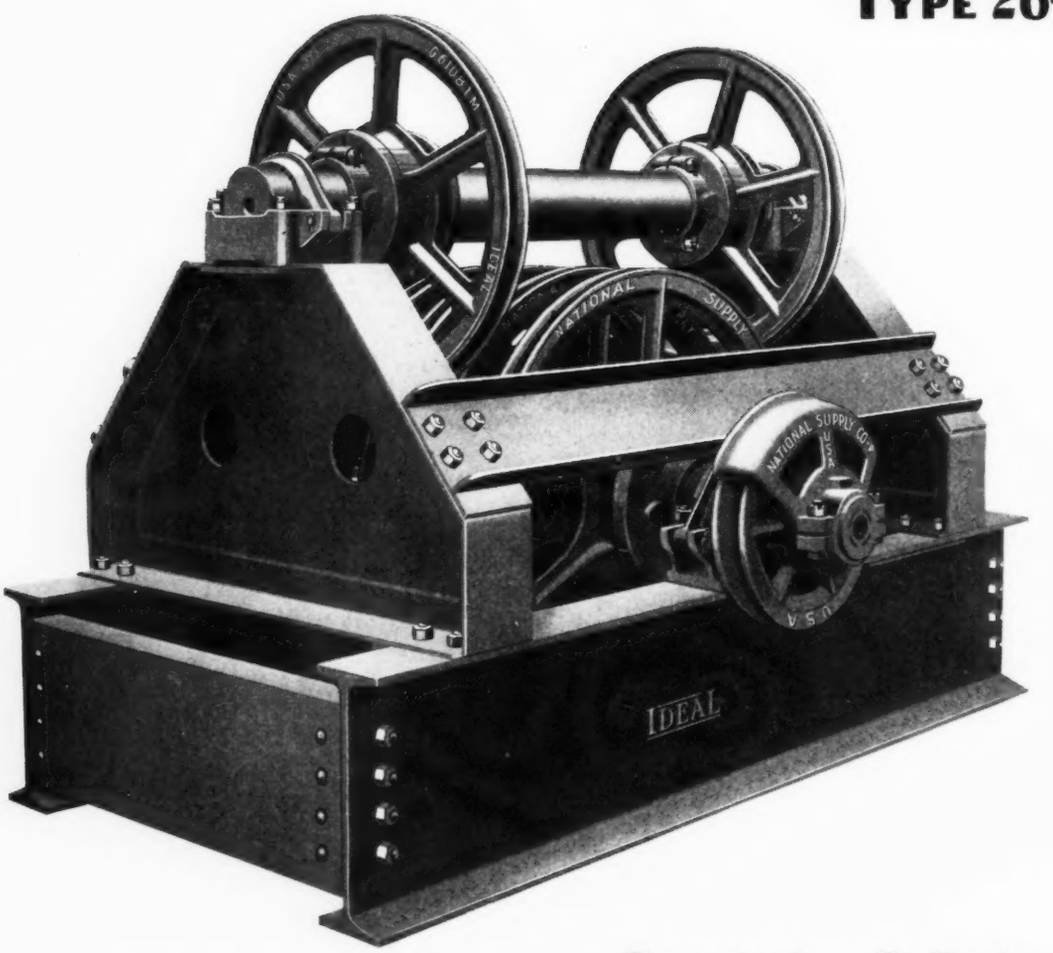
Perhaps a steam superheater should be installed. Perhaps a feed water heater. Perhaps an automatic feed water regulator. Or a modern damper regulator, steam purifier, steam trap, automatic combustion control system pump governor, steam flow meter, etc. All of these devices are of great importance in the modernization of power plants. It is possible to do almost anything to an old boiler plant with the exception of making the boiler stronger so that steam pressure can be increased.

# IDEAL

## ROLLER BEARING

# CROWN BLOCK

**TYPE 26-C0**




**Descriptive Bulletin**

**No. 93**

**Sent on Request**

**THE NATIONAL SUPPLY COMPANIES**

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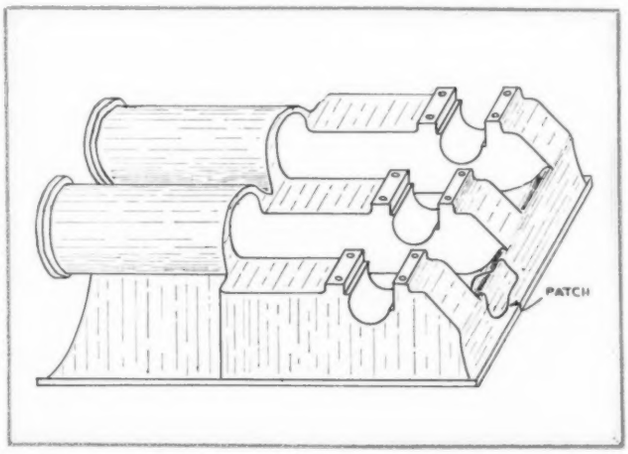
# Unusual Engine Frame Repair Job

*By* A. A. HARDY, *Engineer, The Prairie Pipe Line Co.*

ACCIDENTS resulting in broken machinery are bound to occur in any plant where full time or even partial time operation is in effect, regardless of the skill and competency of the operators. When an accident results in a cracked or broken pump or engine frame in a pipe line pumping station it is a serious affair. Sometimes the crack can be pulled together with shrink links, thus effecting a valid repair. Sometimes the repair can be made by caulking, by brazing and so-called "dental" work or by several different means, each individual case calling for its own individual solution. Such cases usually call for a good deal of ingenuity and skill, for there is always a good and a bad way of doing the job as with anything else. If ingenuity and skill are available, an effective repair can be made even on frames that at first consideration can only be junked, thus saving the concern in question considerable time and money.

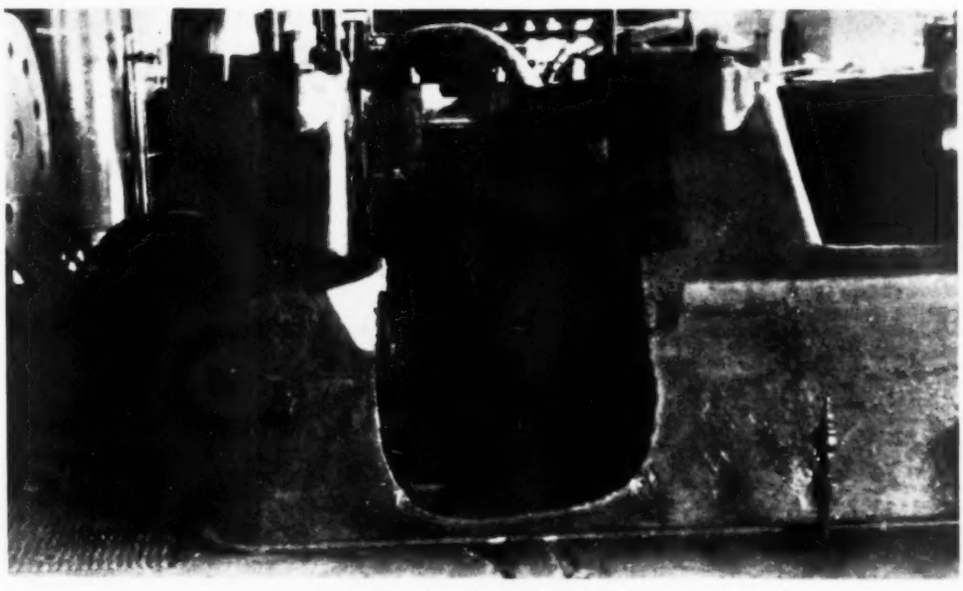



Sketch of engine frame after being repaired.

One of the major pipe line companies in the mid-continent field recently had an accident that resulted in a cracked frame which was repaired in a way that is worthy of note. The frame that was damaged was that of a 300-horse power oil engine. This engine is a four-cycle, horizontal, two-cylinder, 20-inch by 33-inch bore and stroke, Diesel engine, weighing slightly over 100,000 pounds complete.

In this case one of the connecting rod bearing adjusting bolts broke, allowing the nut to fall on the cross head slide, where it was caught between the cross head and the slide. This resulted in tearing the connecting rod loose from the cross head. The connecting rod was then thrown upward and stood in a vertical position directly over the crank shaft for two or three revolutions of the shaft, after which it fell backwards away from the engine head and kicked a gapping hole in the double wall of the engine frame at the back. The piston and cross head remained in the engine and the only serious damage done, outside of the splasher or crank case cover, which was torn up, was the big hole in the frame. The picture at the bottom of the page gives a fairly good idea of the extent of the damage.

At first glance it seemed that the frame was fit only to be junked, but this would have necessitated two or three months' delay at the least, waiting for the casting to be made and shipped, besides the expense of initial cost amounting to around three or four thousand dollars, plus freight and erection costs. It was finally decided that a patch could be made with a special cast iron casting and put in place either with shrink links and dental work, or by welding. The shrink links and dental work at the best would hardly make a neat appearing job when finished,

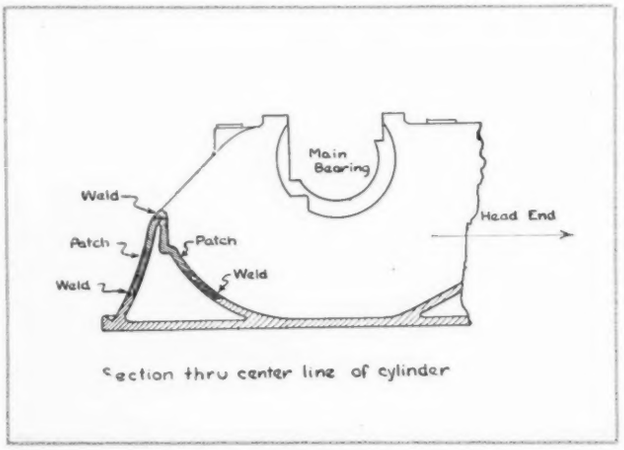


End view of engine ready for patch.

hence welding was chosen as the method to be used.

The particular type of welding to be used in a case of this sort is always a problem. Some cast irons are of such a texture that they are broken down completely under the welding flame. It is always a good plan to have an expert test the cast iron in the particular piece of machinery to be welded before final plans for the job are made. The iron in this frame in question was tested and found to be of such a texture that it would take the weld satisfactorily.

In this particular case, electric welding was more or less out of the question. Regular cast iron welding would do if preheated sufficiently. This type of welding, however, calls for a preheat almost to the point of flow of the metal. Obviously this could not be done with the engine on the foundation. Bronze welding is just as strong as the regular iron weld for this type of repair and requires much lower preheating, consequently this method was chosen.




The next problem to be met was that of having a casting made of the proper size and contour to just fill the gaping hole. Of course, the hole was trimmed back until all cracks were eliminated and the edges were comparatively smooth. A template of sheet brass was then made in such a manner that it gave the correct angles, sizes and contours. This template was then taken to a foundry and the casting made.

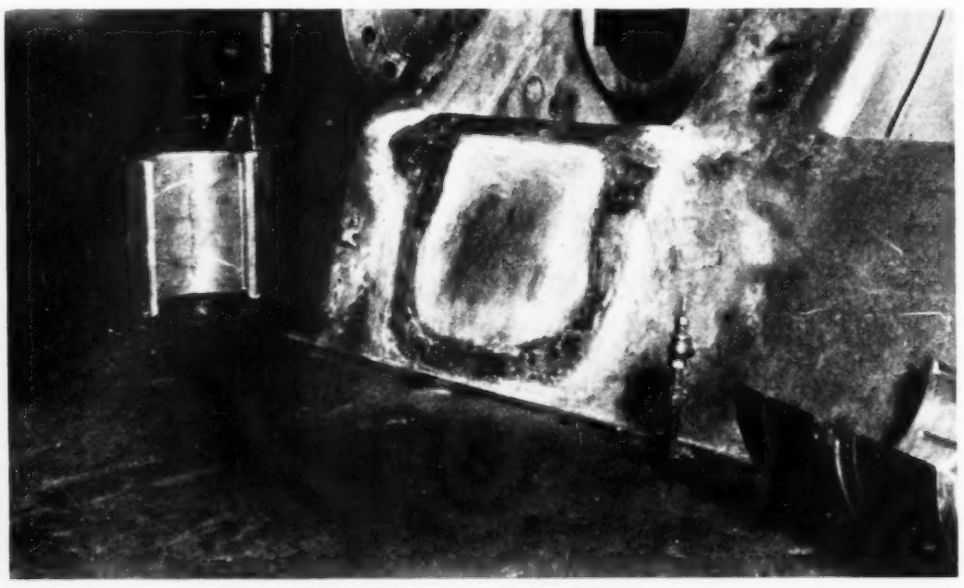
As mentioned before, the broken wall at this point is double or rather in the form of an inverted "V." The casting was made in two pieces, one piece about 18 inches by 24 inches in size, covering the hole in the inside crank case of the frame and extending to the top or ridge of the "V" and the other piece about 18 inches square, extending from ridge on the outside and down the outer wall of the frame.

These castings were then taken to the location of the engine and fitted into the hole. After being trimmed up and beveled for welding it was found to be a good fit. Holes were then drilled and tapped near the outer edges of the castings, and brass studs inserted in such a position that they angled out toward the edge. Corresponding studs were placed at the edges of the hole in the frame in such a position that they angled towards the studs in the castings. The heads of these studs were then tack welded together, thus giving an effective means of holding the casting in place while the bronze weld was being made.

It was then necessary to preheat the frame for welding. There was no gas available at this station and it would have been out of the question to lay a gas line from the nearest source of supply. The preheating was done with Skelgas and was accomplished in a very satisfactory manner. It was, of course, necessary to heat the frame adjacent to the weld to a point just below visibility or to the point where the heated iron would char the end of a stick held against its surface.

The bronze welding was then done. It should be noted that the edges of both the castings and the frame at the hole, were beveled to receive the bronze. At the top or junction of the two pieces of the patch the material was cut down an inch or an inch and a half below the regular contour of this ridge, thus allowing the joint to be made by building bronze back to the regular level.

Contraction of the heated parts and of the weld in particular was anticipated. An attempt to compensate for this effect was made by intensely peening the weld as it cooled. It was realized that any contraction at this point in the frame would tend to warp the main bearing jaws out of line and would result in a consequent misalignment of the crank shaft. It may be of interest to know that eighty pounds of bronze were required for this job, number twenty was used and the job was finished in fourteen hours of continuous welding. Total cost of the repair was $300.



Close-up view of patch welded in place.

# Reducing Refinery Accidents

*By* H. N. BLAKESLEE

DURING the past few years many remarkable records have been made by refineries in the reduction of their lost-time accidents. For example, one refinery, which was employing about 4,000 men, spent $175,000 in 1918 for industrial accidents, representing an average of about $44 per man. In 1928 this same plant spent $30,000 for industrial accident claims, plus the cost of its safety department, which represented a reduction of its accident costs to an average of about $7.50 per man.

The recent accident reports that have been coming to the National Safety Council also indicate that steady, month-by-month accident prevention progress is being made, on the average, by the refineries that are taking part in the 1930 Petroleum Safety Contest.

A few general comparisons will illustrate this accident prevention progress. For the year 1929 a total of about 3,600 industrial establishments, representing 27 different industrial groups, reported their accident experience to the National Safety Council. The average accident frequency rate for all of these establishments—that is, the number of lost-time personal injuries per 1,000,000 hours of work—was 25.53. In comparison, the petroleum industry as a whole showed an accident frequency rate for 1929 only slighter higher—that is, a total of 26.78 lost-time accidents per 1,000,000 hours of work.

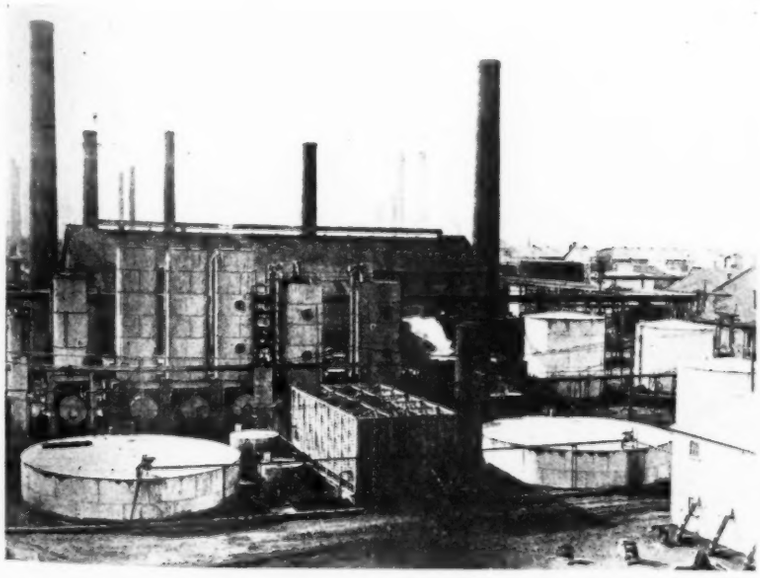
Further analysis of this 1929 record shows that the accident frequency rate in the marketing division of the petroleum industry was quite low—namely, 12.42; and the accident frequency rate in the production division was relatively much higher—namely, 47.68. The accident experience of refineries (the manufacturing department) was between these two—namely, an accident frequency rate of 21.06, which is about 17 per cent less than the average for all of the 3,600 establishments which reported to the National Safety Council for 1929.

**Struck anywhere, matches have caused many fires.**

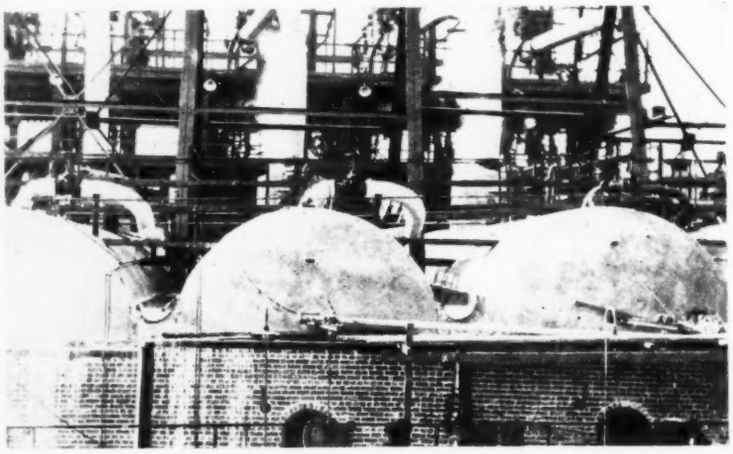
[1] Petroleum Representative, National Safety Council.

Accident severity rates in petroleum refineries—that is, the number of days lost from accidents per 1,000 hours—are relatively high. For example, the average accident severity rate for all of the 3,600 establishments that reported to the National Safety Council in 1929 was 2.23. In contrast, the accident severity rate for refineries was 2.62. In comparison, other departments of the petroleum industry reported the following accident severity rates: Marketing department, .74; natural gas and gasoline department, 1.25; marine department, 2.46; pipe line department, 2.55; production department, 4.59.

It may be of interest also to know the relative rank in accident frequency rates for refineries in the five different geographical divisions which report to the petroleum section of the National Safety Council. The refineries which reported in 1929 in the Pacific division had an accident frequency rate of 15. The Atlantic division ranked second with an accident frequency rate of 17.78. Great Lakes division was third with a rate of 19.30. The accident frequency rate of the refineries in the Gulf division was 25.75, and in the Mid-Continent division 30.57.



**View of the Whiting refinery of the Standard Oil Co. (Indiana).**



Heavy construction work in refineries is no longer considered a justification for a poor accident record.

The accident prevention contests which have been conducted, beginning in 1928, by the petroleum division of the National Safety Council have been quite encouraging. The average accident frequency rate of all refineries which took part in the 1928 no-accident contest was 15.75. In 1929 there was a large increase in the number of plants which reported, including some plants rather new in intensified accident prevention work, and the average accident frequency rate advanced to 17.26. But for the first four months of the 1930 contest, a still larger number of manufacturing units reported an accident frequency rate of 15.45, which represents splendid accident prevention progress.

One of the refineries which has been taking part in these contests — the Wood River refinery of the Standard Oil Company (Indiana) — reported a perfect no-accident record between December 29, 1928, and October 3, 1929. It reported a total of 2,080,869 man-hours of work without a lost-time accident. During the entire year of 1929 this refinery had only one lost-time accident.

This is the best individual refinery accident record which has been reported to the National Safety Council; and, so far as known, this is the best record, from the viewpoint of total man-hours worked, that has been reported by any department of the petroleum industry. The nearest competing record that has been reported was that made by the marketing department of the Minneapolis division of the Standard Oil Company (Indiana), with a total of 1,987,200 man-hours without a lost-time accident.

What may be accomplished in accident prevention by an individual refinery is well illustrated by the experience during the past 13 years of the Whiting refinery of the Standard Oil Company (Indiana). For the year 1917 this plant had 624 lost-time accidents, representing a frequency rate of 77.6. In 1918 it began systematic accident prevention work and for that year it reduced its lost-time accidents to 576, representing a frequency rate of 69.4. There was a steady accident reduction year after year, and for 1924 only 87 lost-time accidents were reported, representing a frequency rate of 9.2. During the closing months of 1928 the 4,000 employes at the Whiting refinery were able to operate 60 days, or approximately 2,000,000 man-hours, without a lost-time accident. For the entire year of 1928 they had only 42 lost-time accidents and the plant's accident frequency rate was 5.1. For the year 1919 the paraffine department of this plant made a strenuous but unsuccessful effort to go an entire month without a lost-time accident. For the month this department had four accidents and 37 accidents for the year. In contrast, for the entire year of 1928 this department with 367 employes did not have a single lost-time accident.

The accident prevention methods of this plant included a card record of every accident, and these accidents were classified and charged against the records of the various foremen. The accident history of each foreman soon came to be interpreted in terms of efficiency. The management, in the selection of a new foreman, would invariably ask for the accident records of the men who were being considered for possible employment. All new employes were impressed with the importance of accident prevention and a complete report of each accident. Departmental safety committees were developed and a "suggestion system" for the entire plant was credited with many valuable ideas in accident prevention.

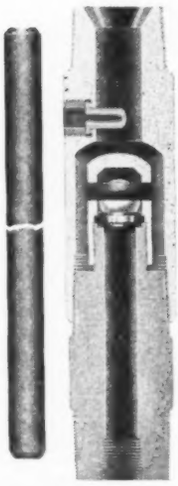
Doubtless one of the most important reasons for this splendid accident record was the thorough belief in the plan by the management. For example, Dr. R. E. Humphreys, a former manager of the Whiting refinery and now a vice-president and a member of the board of directors of the greater company, in an address before the petroleum section of an annual safety congress, made the following statement: "One-sided safety can never be successful. The manager must put his own house in order before he expects others to come and dwell with him. Employes will never enter into the spirit of safety if they observe all about them evidences of the failure of management to do its own part. You cannot sincerely blame a workman for not wearing goggles if he must keep his eyes skinned to avoid falling off an unprotected scaffold. He is likely to ask why you didn't put a hand rail on the scaffold so that he wouldn't fall off and break his neck. Every chance for such a comeback must be completely eliminated before any start in safety work can be instituted."

The hose mask is used to protect workers against vapors.

## McKissick Tubing Bleeder and Valve

(Patent Applied For)

The hollow plug breaks off and permits the fluid to drain back in the well—a saving of time and oil and a reduction of fire hazard. The ball raises only 5/16 inch, preventing pounding, which means longer pumping life.



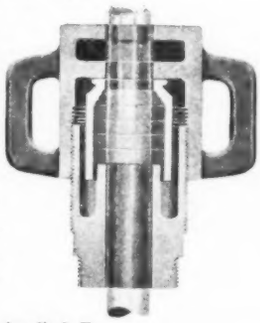
## Peerless LOAD BINDER and JACK

All-steel, built for severe abuse—can easily handle any amount of chain—extra boomers in binding loose loads unnecessary. The chain can be taken up or let out as desired. Two sizes: 32 lbs., and 20 lbs. U. S. Pat. No. 281,860 299,423

## Peerless STUFFING BOX

(Floating Type)

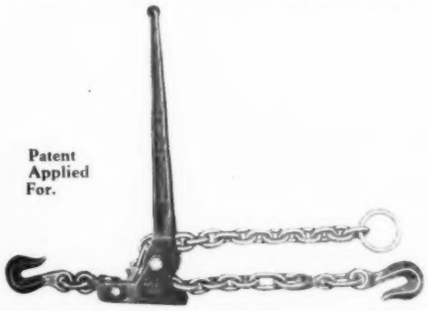
Simple in construction, of three parts, which gives longer life and easier packing conditions at lowest cost. Full floating principle which eliminates oblonging and burning out the rings.



Patent Applied For

## Peerless SPEED JACK

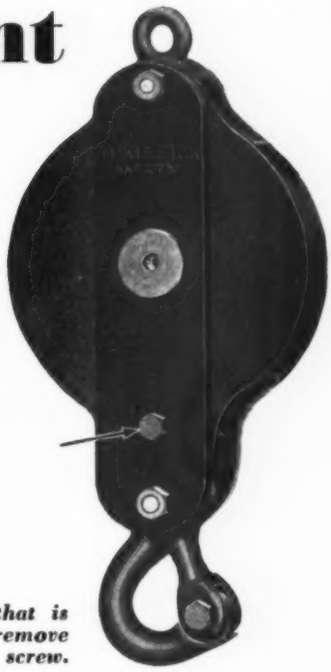
Patent Applied For.



All-steel; designed to lift or pull very heavy loads with greatest speed. Equipped with the strongest steel loading chain obtainable. Compact and light, weighing only 24 lbs. with 4-foot chain assembly. Also furnished with 10-foot chain, or longer chain if wanted.

# Peerless Quality Equipment

*Built to Stand Strenuous use*



## McKISSICK SAFETY TUBING BLOCK

U. S. Pat. No. 17,211 and others

*To thread, all that is necessary is to remove this small set screw.*

***The McKissick Safety Block is the one safety block which is absolutely safe at all times.*** **The block cannot be used without the safety guard — the safety guard is an integral part of the block. Both the top and bottom beckets are entirely enclosed, eliminating fouling and catching. These safety features are appreciated by oil field workers.**

**The block can be threaded without removing either the top or bottom becket. Removal of one small set screw is all that is necessary.**

**McKissick sheaves are *all-steel*, and the line grooves are machined to size. They are equipped with oil reservoir for automatic lubrication; adds life to the bearings.**

**These features make the McKissick Safety Block the first choice of the oil industry. Made in full range of sizes needed.**

**For Peerless Equipment see your supply company or write us.**

# *Peerless*

## SUPPLY COMPANY, Inc.

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**Tulsa, Oklahoma**

*When writing* PEERLESS SUPPLY COMPANY, INC., *please mention The Petroleum Engineer*

*Data on the*

# Manufacture *of* Compounded Marine Engine Oils

*By* H. L. KAUFFMAN
*Petroleum Consultant*

"MARINE engine oil" is a product that can conveniently be made by the oil refiner or compounder and on which a good profit can be made. But, it is not an easy lubricant to manufacture and to make a satisfactory product one must have some prior knowledge or experience relative to its compounding.

The term "marine engine oil," as commonly understood, has reference to a lubricant made by compounding a petroleum oil with blown rapeseed oil, the resultant product possessing the ability to form a rich emulsion when brought into contact with water. It does *not* refer to such straight mineral oils as are used in marine steam turbines, crankcase engines, dynamo bearings, steam cylinders, Kingsbury thrust bearings, etc.

Marine engine oils, made in the manner mentioned above, are used to lubricate the crossheads, pins, guides, eccentric straps, links, horseshoe thrust spring bearings, top and bottom ends of rods, and drip cups and combs on crossheads as found on reciprocating marine steam engines. However, the use of marine engine oil is not, as its name suggests, restricted to lubrication on board ship; many uses have been developed for this product in industrial lubrication and, in many ways, it is one of the most important of industrial lubricants for general use.

It is true that straight mineral oil, such as heavy red engine oil, owing to its lower first cost per gallon, is sometimes used for the purpose to which a compound marine engine oil is generally placed. However, a well-made compounded oil will reduce lubrication costs over and above the lower-priced red engine oil, because less of the former is required to obtain better results.

### *Object of Compounding*

The object in compounding mineral oils with blown rapeseed oil is to impart to the former desirable emulsifying qualities. After the oil is in a state of emulsion, its viscosity is raised and its adhesive and cohesive qualities are enormously increased. In this condition the oil is able to resist successfully the washing effect of water, which is always present around a marine engine. This emulsified oil clings tenaciously to the bearing surfaces, acting also as a temperature indicator. Lard oil or other readily emulsifiable animal or vegetable oils are occasionally compounded with mineral oil to make marine engine oils, but it is much more the common practice to make use of blown rapeseed oil. Blown rapeseed oil is preferred for use due chiefly to the fact that because of its higher viscosity a smaller amount of the blown product than of the unblown will "thicken" satisfactorily the mineral oil.

The compounding of mineral oil with rapeseed oil is one of the most difficult types of blend that the refiner or compounder is called upon to make. This is because of the tendency of rapeseed oil to separate-out from the mixture.

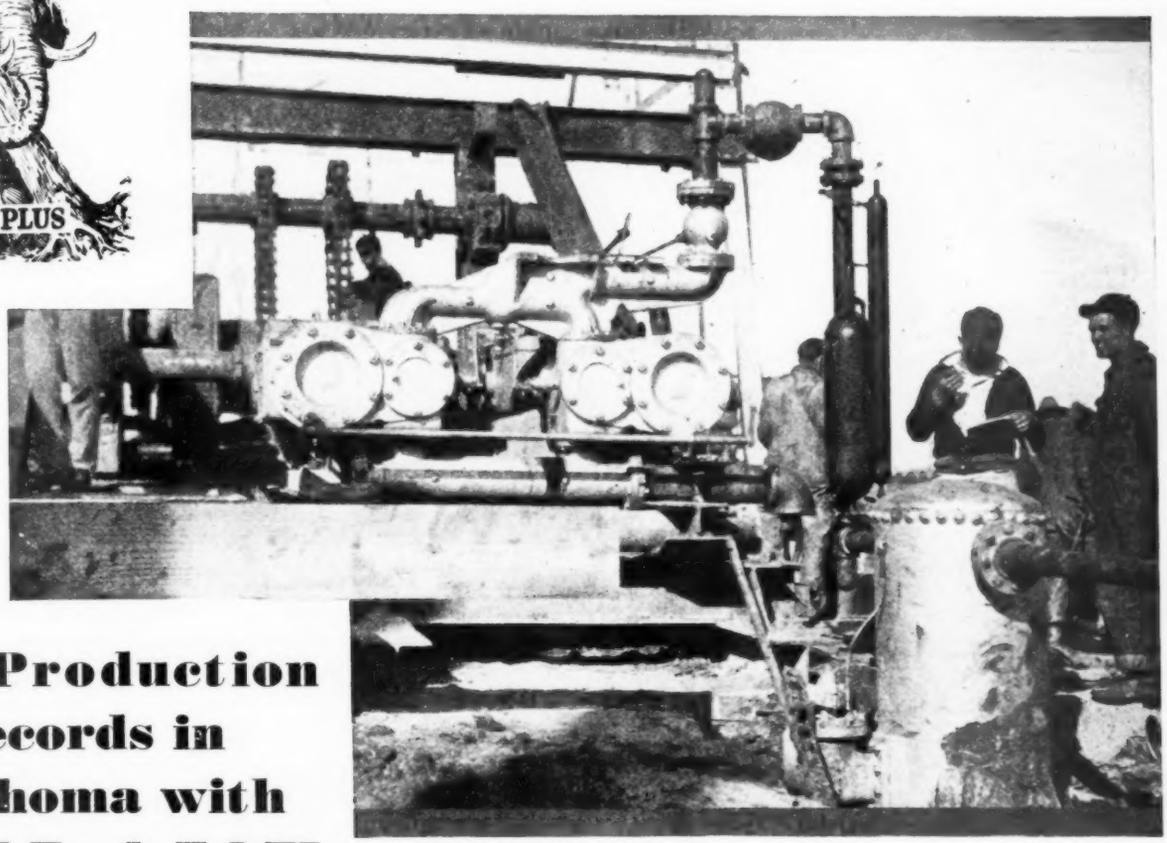
The present article will be limited to the presentation of data obtained from experimental work on making compounded marine engine oils, together with a discussion of same.

Table 1 shows the characteristic properties of various samples of blown and unblown rapeseed oils, which oils were used later in conducting the investigational work.

From the result of tests shown in this table, note especially that blowing increases the viscosity and decreases the gravity of the rapeseed oil. These changes in physical char-

Airplane view of Transcontinental Oil Co.'s refinery, Ft. Worth, Texas.—Courtesy Texas Flying Service, Inc.

*New IDEAL - AJAX 12x12 Twin Roller Bearing Engine with extra heavy Steam Separator. Operated by Hemrich & Payne, Oklahoma City, Okla.*



# New Production Records in Oklahoma with IDEAL-AJAX

Reports from the field give new performance records for IDEAL-AJAX equipped with extra heavy Steam Separator. You can secure detailed information from the National Supply Company man.

THE first steam separators used in the oil fields were developed by AJAX to speed up operations with piston valve roller bearing engines.

All other AJAX and IDEAL-AJAX engines in the field not equipped with roller bearings are of the slide valve type. It has been found that these engines also show improved performance by hooking up the extra heavy separator. It relieves the engine of forcing water back thru the valves and insures better lubrication because water is not present to wash sides of cylinder walls and valve seats.

Ask your National Supply Company man about equipping your engines with the extra heavy Steam Separator.

# IDEAL-AJAX

## ROLLER BEARING STEAM DRILLING ENGINES

*Made by* **AJAX IRON WORKS,** *Corry, Pa.*

TABLE 1

*Properties of Blown and Unblown Rapeseed Oils*

| | Sample No. 1 Unblown rapeseed oil (refined) | Sample No. 2 Unblown rapeseed oil (refined) | Sample No. 3 Unblown East Indian refined rapeseed oil | Sample No. 4 Unblown English refined rapeseed oil | Sample No. 5 Unblown English refined rapeseed oil | Sample No. 6 Unblown Japanese refined rapeseed oil | Sample No. 7 Blown rapeseed oil | Sample No. 8 Blown rapeseed oil | Sample No. 9 Blown rapeseed oil |
|---|---|---|---|---|---|---|---|---|---|
| Gravity | 23.2 | 23.1 | 23.1 | 23.2 | 23.2 | 25.1 | 11.3 | 15.9 | 12.4 |
| Flash, ° F. | 600 | 595 | 605 | 605 | 590 | 600 | 470 | 470 | 460 |
| Viscosity at 100° F. | 216 | 223 | 218 | 217 | 219 | 228 | ..... | ..... | ..... |
| Viscosity at 210° F. | 57 | 57 | 57 | 57 | 57 | 57 | 458 | 232 | 472 |
| Color, N. P. A. | 1-1½ | 1-1½ | 1-1½ | 1-1½ | 1-1½ | 1½-2 | 5½ | 3 | 2½ |
| Pour Test, °F. | Zero | ..... | 5 | 5 | 10 | Zero | 40 | 10 | 20 |
| Saponification value | 176.5 | 177 | 175.5 | 176.2 | 180 | 179 | 220 | ..... | ..... |
| Iodine value | 102.9 | 102 | 101 | 103.4 | 100.1 | 102 | 64.3 | ..... | ..... |
| Free fatty acids (as oleic) % | 1.75 | 1.14 | 0.99 | 1.25 | 1.23 | 0.50 | 6.0 | 6.0 | 9.0 |

acteristics, as is obvious, add to the difficulty of making the rapeseed oil mix completely with the mineral oil.

### *Blowing of Rapeseed Oil*

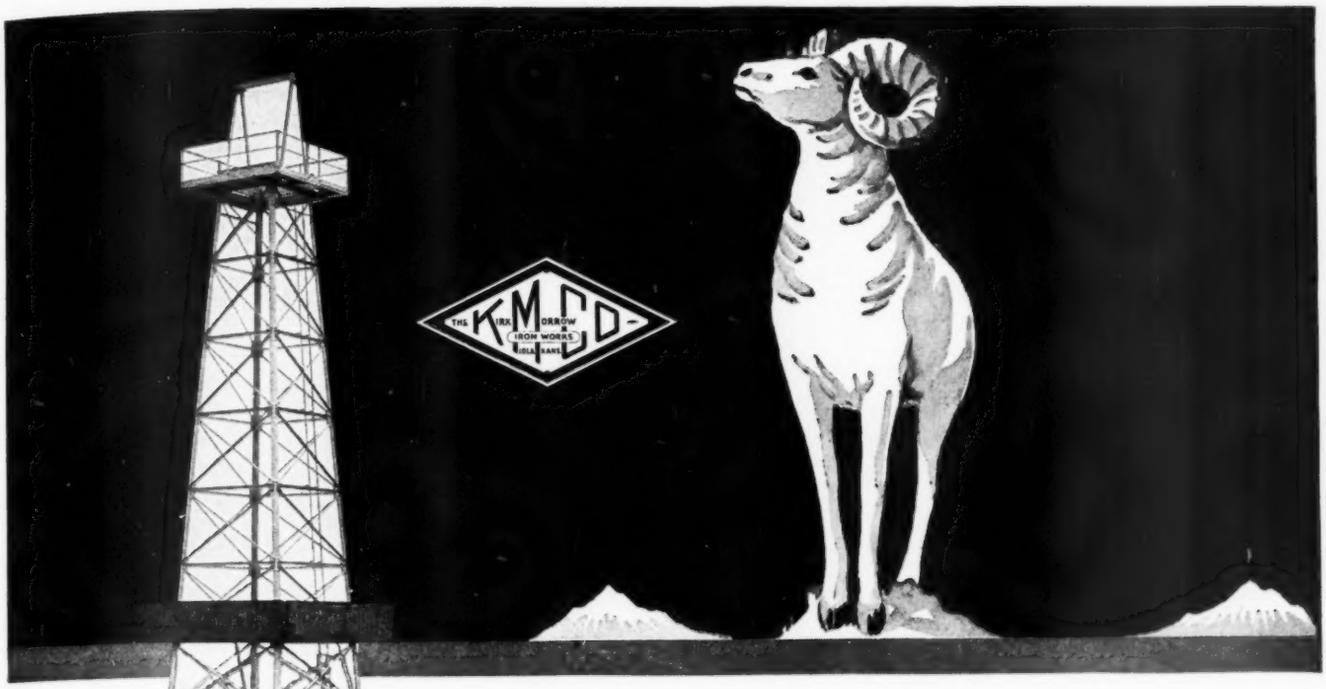
Many manufacturers of marine engine oils find it to their advantage to blow rapeseed oil in their own plant. The advantage of this lies in the fact that thereby blown rapeseed oil of the particular qualities that will blend most satisfactorily with the manufacturer's own grade of mineral oil can be obtained. But, if a blown rapeseed oil can be purchased that will make a permanent blend with the particular mineral oil that that manufacturer has available for use, it is generally more of an advantage financially to purchase the blown oil than it is to make such a product in the compounder's plant. However, for those who either are now blowing rapeseed oil or who contemplate so doing, the following data showing the changes that take place in rapeseed oil upon blowing will be given. The results of blowing eleven different batches of rapeseed oil under different conditions will be tabulated, the general procedure followed in blowing being essentially as follows:

The first five batches were blown in one-gallon cans, the air being introduced through a "spider". The temperature and velocity of blowing were varied to determine their relative effects. The temperatures on the contents of these cans were maintained by keeping the cans immersed in steam-jacketed kettles of three gallons capacity, using one gallon charges. These kettles were kept at a constant temperature of 210 degrees F. by the use of exhaust steam. Four-ounce samples of the blown rapeseed oil were removed from the batches at intervals and physical and chemical tests made. The blown rapeseed oil was also mixed with "600 red oil, treated" to determine the maximum viscosity to which the oil could be blown and yet remain in solution when mixed with the 600 red oil. The blown rapeseed oil was mixed with the 600 red oil at about 180 degrees F., in such proportions as would yield a resultant product having a viscosity of about 70 seconds at 210 degrees F.

The data obtained upon making these blowing tests follow:

Above — Taylor field in Williamson County, Texas, from the air—Courtesy Texas Flying Service, Inc.

At left—Waggoner Refining Co. Plant, Electra, Texas—Courtesy Texas Flying Service, Inc.



# POISE

**Only the well-balanced achieve poise. It is significant, then, that the KM CO Steel Derrick stands at all times erect and purposeful, carrying its load without strain.**

**Balance in the KM CO Steel Derrick is obtained by perfected methods of construction which insure the exact fit of every part upon the other, so that sound rigidity results. Each leg has a milled end which gives it full bearing on the leg below, distributing the load correctly and uniformly from the crown block to the foundation. Gusset plates at all leg splices are of one piece, special quality flanging steel and inner splice angles are milled to fit the fillet of the derrick leg. One size bolts for all connections. Legs are uniform and interchangeable. A. P. I. Specifications dictate the design.**

**PRODUCTS:**
Steel Derricks, Rig Irons, Bull Wheels, Calf Wheels, Band Wheels, Crown Blocks, Tug Wheels, Sand Reels, Steel Tankage, Floating Roofs, Tank Fittings, Refinery Equipment, Steel Plate Construction

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BATCH No. 1

| | Hrs. | Temp. °F. | Vis./210 | Gravity | S.V. | Pct. F.F.A. | I.V. | Color N.P.A. |
|---|---|---|---|---|---|---|---|---|
| Original oil | .... | .... | 57 | 23.2 | 176.5 | 1.75 | 102.9 | 1-1-½ |
| After blowing | 10 | 200-220 | 150 | | | | | |
| After blowing | 16 | 210-220 | 390 | | | | | |
| After blowing | 24 | 210-220 | 652 | 11.1 | 241 | 13.0 | 44.6 | 2-2-½ |

Note: This batch was blown vigorously with hot air. Mixes were made with 600 red oil, treated with 600 red oil, filtered, and with 750 pale oil, using only the blown rapeseed oil of 652/210 viscosity. All mixes showed separation.

BATCH No. 2

| | Hours | Temp. °F. | Vis./210 | Gravity | Color | S.V. | Pct. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|---|
| Original oil | .... | .... | 57 | 23.2 | 1-1-½ | 176.5 | 1.75 | 102.9 | ..... |
| After blowing | 33 | 180-200 | 147 | | | | | | |
| After blowing | 37 | 190 | 198 | | | | | | |
| After blowing | 39 | 190 | 289 | | | | | | OK |
| After blowing | 50 | 180-190 | 389 | | | | | | * |
| After blowing | 56 | 180-190 | 446 | 10.9 | 2 | 250 | 16.1 | 42.3 | * |

* Separated.

Note: This batch was blown vigorously with warm air.

BATCH No. 3

| | Hours | Temp. °F. | Vis./210 | Gravity | Color N.P.A. | S.V. | Pct. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|---|
| Original oil | .... | .... | 57 | 23.1 | 1-1-½ | 177 | 1.14 | 102 | ..... |
| After blowing | 7 | 210 | 88 | | | | | | |
| After blowing | 16 | 210 | 187 | | | | | | |
| After blowing | 22 | 210 | 212 | | | | | | |
| After blowing | 26½ | 210 | 240 | | | | | | |
| After blowing | 32½ | 210 | 295 | 13.5 | 1-½-2 | 229 | 9.4 | 52.8 | OK |
| After blowing | 37½ | 210 | 375 | 12.7 | 2-2-½ | 232 | 10.1 | 50.3 | OK |
| After blowing | 41 | 210 | 480 | 12.2 | 2-½-3 | | | | * |
| After blowing | 44 | 210 | 597 | 11.8 | 3 | | 10.9 | 41.8 | * |

* Separated.

Note: This batch was blown vigorously, using cold air.

BATCH No. 4

| | Hours | Temp. °F. | Vis./210 | Gravity | Color N.P.A. | S.V. | Pct. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|---|
| Original oil | .... | .... | 57 | 23.1 | 1-1-½ | 177 | 1.14 | 102 | ..... |
| After blowing | 13½ | 220 | 130 | | | | | | |
| After blowing | 17½ | 220 | 160 | | | | | | |
| After blowing | 21 | 220 | 206 | | | | | | |
| After blowing | 24 | 220 | 232 | | | | | | |
| After blowing | 26 | 220 | 265 | | | | | | |
| After blowing | 27 | 220 | 292 | 14.4 | 1-½-2 | | | | OK |
| After blowing | 31½ | 220 | 345 | 13.7 | 2-2-½ | | | | OK |
| After blowing | 34½ | 220 | 439 | 13.0 | 2-2-½ | | 8.7 | 51.7 | OK |
| After blowing | 36½ | 220 | 487 | 12.9 | 2-½ | 232 | 8.8 | 51.7 | OK |
| After blowing | 40½ | 220 | 642 | 12.4 | 2-½-3 | 239 | 9.1 | 50.9 | * |
| After blowing | 42½ | 220 | 724 | 12.4 | 2-½-3 | | | | * |

* Separated.

Note: This batch was blown at a moderate rate and at a relatively high temperature.

BATCH No. 5

| | Hours | Temp. °F. | Vis./210 | Gravity | Color N.P.A. | S.V. | Pct. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|---|
| Original oil | .... | .... | 57 | 23.1 | 1-1-½ | 177 | 1.14 | 102 | ..... |
| After blowing | 14 | 192 | 123 | | | | | | |
| After blowing | 20½ | 190 | 164 | | | | | | |
| After blowing | 28 | 194 | 212 | | | | | | |
| After blowing | 32½ | 191 | 223 | | | | | | |
| After blowing | 36½ | 193 | 250 | | | | | | |
| After blowing | 42 | 190 | 278 | | | | | | |
| After blowing | 44 | 193 | 297 | 13.6 | 3-½-4 | | | | OK |
| After blowing | 48½ | 195 | 334 | | | | | | |
| After blowing | 52 | 188 | 358 | 13.1 | 4 | | | | OK |

BATCH No. 5—Continued

| | Hours | Temp. °F. | Vis./210 | Gravity | Color N.P.A. | S.V. | Pct. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|---|
| After blowing | 58 | 193 | 420 | 12.7 | 4 | | 9.4 | 52 | OK |
| After blowing | 63 | 197 | 481 | 12.4 | 4-4-½ | 245 | 9.1 | 51.2 | OK |
| After blowing | 69½ | 194 | 665 | 11.9 | 6 | 250 | 9.0 | 51.1 | * |

* Separated.

Note: This batch was blown at a low temperature, at a moderate rate. The batch was discolored through local overheating with a free flame.

BATCH No. 6

| | Hours | Temp. °F. | Vis./210 | Gravity | Color N.P.A. | S.V. | Pct. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|---|
| Original oil | .... | .... | 57 | 23.1 | 1-1-½ | 177 | 1.14 | 102 | ..... |
| After blowing | 24 | 210 | 67 | | | | | | |
| After blowing | 72 | 211 | 102 | | | | | | |
| After blowing | 96 | 210 | 123 | | | | | | |
| After blowing | 120 | 210 | 153 | | | | | | |
| After blowing | 141 | 210 | 201 | | | | | | |
| After blowing | 154 | 210 | 252 | | | | | | |
| After blowing | 160 | 210 | 270 | | | | | | |
| After blowing | 169 | 210 | 295 | 15.8 | 2-½-3 | 212 | 3.9 | 60 | |
| After blowing | 181 | 210 | 343 | | | | | | |
| After blowing | 192 | 210 | 403 | 15.2 | 3 | | | | |
| After blowing | 200 | 210 | 465 | 15.0 | 3 | 216 | 6.0 | 57.6 | OK |
| After blowing | 209 | 210 | 520 | 14.9 | 3 | | | | OK |
| After blowing | 215 | 210 | 579 | 14.4 | 2-½-3 | | | | OK |
| After blowing | 218 | 210 | 620 | | | | | | OK |
| After blowing | 223 | 209 | 682 | 14.3 | 3 | 222 | 5.7 | 54.0 | OK |
| After blowing | 231 | 210 | 827 | 13.9 | 3-3-½ | | | | OK |
| After blowing | 234 | 210 | 886 | | | | | | |
| After blowing | 242 | 210 | 1134 | 13.1 | 2-½-3 | | | | OK |
| After blowing | 248 | 208 | 1454 | 13.1 | 2-½-3 | 225 | 7.3 | 47.7 | OK |

Note: The 1454-viscosity sample developed a small amount of separation after standing for six months.

BATCH No. 7

| | Hours | Temp. °F. | Vis./210 | Gravity | Color N.P.A. | S.V. | Pct. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|---|
| Original oil | .... | .... | 57 | 23.2 | 1-1-½ | 176.5 | 1.75 | 102.9 | ..... |
| After blowing | 24 | 210 | 60 | | | | | | |
| After blowing | 47 | 210 | 76 | | | | | | |
| After blowing | 56 | 210 | 86 | | | | | | |
| After blowing | 72 | 210 | 131 | | | | | | |
| After blowing | 82 | 210 | 193 | | | | | | |
| After blowing | 94 | 210 | 265 | | | | | | |
| After blowing | 104 | 210 | 365 | 14.4 | 2-½ | | | | OK |
| After blowing | 115 | 210 | 437 | 14.4 | 3 | 214 | 5.9 | 53.3 | OK |
| After blowing | 121 | 210 | 494 | 14.2 | 3 | | | | OK |
| After blowing | 128 | 210 | 592 | 13.9 | 3-½ | | | | OK |
| After blowing | 132 | 209 | 662 | | | | | | |
| After blowing | 136 | 210 | 722 | 13.7 | 3-3-½ | 220 | 6.5 | 51.1 | OK |
| After blowing | 143 | 210 | 910 | | | | | | |
| After blowing | 146 | 210 | 946 | | | | | | |
| After blowing | 147½ | 210 | 1038 | 13.1 | 3-3-½ | 225 | 7.3 | 49.3 | OK |

Note: The 1038-viscosity sample developed a small amount of separation after standing for six months and the 722 sample a trace of separation.

BATCH No. 8

| | Hours | Temp. °F. | Vis./210 | Gravity | Color N.P.A. | S.V. | Pct. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|---|
| Original oil | .... | .... | 57 | 23.1 | 1-1-½ | 175.5 | 0.99 | 101 | |
| After blowing | 24 | 208 | 62 | | | | | | |
| After blowing | 47 | 208 | 80 | | | | | | |
| After blowing | 56 | 208 | 103 | | | | | | |
| After blowing | 72 | 208 | 146 | | | | | | |

BATCH No. 8—Continued

| Hours | Temp. °F. | Vis./210 | Gravity | Color N.P.A. | S.V. | Pet. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|
| After blowing .... 82 | 209 | 179 | | | | | | |
| After blowing .... 94 | 209 | 226 | | | | | | |
| After blowing ....104 | 209 | 271 | | | | | | |
| After blowing ....115 | 209 | 329 | 14.4 | 2 | | 6.5 | 53.1 | OK |
| After blowing ....128 | 209 | 429 | 13.8 | 2-2-½ | | | | OK |
| After blowing ....136 | 209 | 496 | 13.7 | 2-2-½ | 222 | 8.6 | 48.1 | OK |
| After blowing ....143 | 210 | 727 | | | | | | |
| After blowing ....150 | 208 | 1015 | 12.1 | 2-½-3 | 232 | 9.5 | 43.6 | * |

*Separated.

BATCH No. 9

| Hours | Temp. °F. | Vis./210 | Gravity | Color N.P.A. | S.V. | Pet. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|
| Original oil ..... .... | ..... | 57 | 23.2 | 1-1-½ | 176.2 | 1.25 | 103.4 | |
| After blowing .... 24 | 210 | 59 | | | | | | |
| After blowing .... 36 | 210 | 72 | | | | | | |
| After blowing .... 48 | 210 | 111 | | | | | | |
| After blowing .... 60 | 210 | 150 | | | | | | |
| After blowing .... 72 | 210 | 195 | | | | | | |
| After blowing .... 84 | 210 | 241 | | | | | | |
| After blowing .... 96 | 210 | 351 | | | | | | |
| After blowing ....108 | 210 | 471 | 13.9 | 3 | 217 | 6.4 | 51.4 | OK |
| After blowing ....120 | 210 | 644 | 13.1 | 3-3-½ | | | | OK |
| After blowing ....132 | 210 | 900 | 12.8 | 3-3-½ | 221 | 7.1 | 49.3 | OK |
| After blowing ....142 | 210 | 1319 | 12.5 | 4-4-½ | 224 | 7.2 | 47.0 | * |

*Separated.

BATCH No. 10

| Hours | Temp. °F. | Vis./210 | Gravity | Color N.P.A. | S.V. | Pet. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|
| Original oil ..... .... | ..... | 57 | 23.2 | 1-1-½ | 180 | 1.23 | 100.1 | |
| After blowing .... 24 | 209 | 59 | | | | | | |
| After blowing .... 36 | 209 | 69 | | | | | | |
| After blowing .... 48 | 209 | 85 | | | | | | |
| After blowing .... 60 | 209 | 109 | | | | | | |
| After blowing .... 72 | 209 | 131 | | | | | | |
| After blowing .... 84 | 209 | 178 | | | | | | |
| After blowing .... 96 | 209 | 236 | | | | | | |
| After blowing ....108 | 209 | 309 | | | | | | |
| After blowing ....120 | 209 | 389 | 13.8 | 1-½-2 | 220 | 7.8 | 47.9 | OK |
| After blowing ....132 | 209 | 527 | 13.0 | 2 | 230 | 8.6 | 46.4 | * |
| After blowing ....144 | 208 | 681 | | | | | | * |
| After blowing ....146 | 208 | 738 | 12.2 | | | 9.2 | | * |
| After blowing ....150 | 209 | 920 | | | | | | |
| After blowing ....157 | 208 | 956 | | | | | | |
| After blowing ....165 | 208 | 1830 | 11.8 | 2-2-½ | | | | * |

*Separated.

BATCH No. 11

| Hours | Temp. °F. | Vis./210 | Gravity | Color N.P.A. | S.V. | Pet. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|
| Original oil ..... .... | ..... | 57 | 25.1 | 1-½-2 | 179.0 | 0.50 | 102 | |
| After blowing .... 12 | 210 | 63 | | | | | | |
| After blowing .... 24 | 210 | 69 | | | | | | |
| After blowing .... 36 | 210 | 89 | | | | | | |
| After blowing .... 50 | 210 | 111 | | | | | | |
| After blowing .... 62 | 210 | 141 | | | | | | |
| After blowing .... 87 | 210 | 220 | | | | | | |
| After blowing ....100 | 210 | 231 | | | | | | |
| After blowing ....112 | 210 | 301 | | | | | | |
| After blowing ....124 | 210 | 427 | 14.3 | 2-½-3 | 211 | 4.5 | 57.8 | OK |

BATCH No. 11—Continued

| Hours | Temp. °F. | Vis./210 | Gravity | Color N.P.A. | S.V. | Pet. F.F.A. | I.V. | Mix with 600 Red |
|---|---|---|---|---|---|---|---|---|
| After blowing ....136 | 210 | 592 | 13.9 | 3-3-½ | | | | OK |
| After blowing ....148 | 210 | 836 | 13.7 | 3 | 218 | 5.4 | 55.5 | OK |
| After blowing ....160 | 210 | 1245 | | | | | | |
| After blowing ....172 | 210 | 2140 | 13.1 | 3-½ | 223 | 5.9 | 50.2 | OK |

Basing conclusions on the results of the above-described laboratory experimental work on air-blowing rapeseed oil, it can be stated that:

1. The most important consideration in blowing rapeseed oil is proper temperature control. The temperature must be kept as low as possible, consistent with effective blowing.

2. The rate of admission of the air is of minor importance, the only thing to guard against being to see that the agitation is not so vigorous that a spray of oil is carried over mechanically.

3. The oil should not be blown to an excessively high viscosity, for by so doing it is very liable to be rendered immiscible with mineral oil.

4. Of the various physical and chemical processing tests that have been applied, no test has been discovered that will indicate the limit to which a batch can be safely blown. However, the gravity test is the most significant and the one that is most easily made. In general, a satisfactory blown rapeseed oil should have a relatively high specific gravity, a high iodine value, a low acidity and a low saponification value.

5. If a sample of "marine engine oil" remains perfectly transparent and shows no separation on standing for two weeks, its permanent stability is almost assured.

6. Samples of the higher-viscosity, blown rapeseed oils which were mixed with mineral oils after having been stored for four months, and which showed no separation after two months' standing, point to the conclusion that a properly blown rapeseed oil may be either compounded at the end of the blowing process or stored for compounding later.

7. The results obtained with these batches failed to establish conclusively whether or not the origin of the rapeseed has anything to do with its suitability for compounding marine engine oils.

8. The rapeseed oil should be blown in a jacketed kettle so connected that either steam or cold water may be admitted for securing proper temperature regulation. This kettle should have a hood leading to an exhauster for removing the noxious gases that are liberated in the blowing process.

9. The temperature for blowing should be kept between 180 and 210 degrees F. and should not be allowed to exceed 220 degrees F. at any time.

10. The rate of blowing should be so regulated that the batch is finished in ninety hours' time or less.

11. For making a marine engine oil, using 600 red oil (asphalt base) as the mineral oil, blowing of the rapeseed oil should be discontinued either when a maximum viscosity of 800 seconds at 210 degrees F. or a minimum gravity of 13.3° A. P. I. is reached.

### *Compounding of Marine Engine Oils*

To give the reader some idea of the various conditions under which blown and unblown rapeseed oil of different viscosities will and will not remain mixed with mineral oil, the results of experimental blends made by compounding the oils in different proportions and by different methods of blending will be given on the following page.

The rapeseed oils used in the experimental blends tested as follows:

| | Rapeseed Oil | Blown Rapeseed 1,000 Viscosity | Blown Rapeseed 1,500 Viscosity | Blown Rapeseed 2,000 Viscosity |
|---|---|---|---|---|
| Grav. | 23.4 | Too viscous to get gravity | | |
| Flash °F. | 440 | 440 | 450 | Frothed over |
| Fire °F. | 650 | Frothed over at 500°F. | | |
| Vis./210 | 69 | 1082 | 1400 | 1900 |
| Color N. P. A. | 3 | 3 (10% soln.) | *3½ (10% soln.) | 3½ (10% soln.) |
| C. T. °F. | 0 | 26 | 38 | 38 |
| Sap. Val. | 175 | 210 | 210 | 210 |
| F. F. A. % | 1.85 | 5.31 | 5.37 | 5.59 |

Two mineral oils of mixed base origin (250 and 300 red oils, treated) and one of asphalt base origin (600 red oil, treated) were used in the blends. These mineral oils tested as follows:

| | 250 Red Oil, Treated | 300 Red Oil, Treated | 600 Red Oil, Treated |
|---|---|---|---|
| Grav. | 25.7 | 27.7 | 20.8 |
| Flash | 405 | 415 | 390 |
| Fire | 470 | 475 | 460 |
| Vis./100 | 247 | 300 | 564 |
| C. T. | 45 | 40 | 0 |
| Color N. P. A. | 6 | 6 | 4½ |

Data on the blends made and the stability of same follow:

**Blend No. 1—15% 2,000 Viscosity Blown Rapeseed Oil; 85% 250 Red Oil, Treated.**

In making this blend the oils were mixed simply by shaking together at 70°F., then setting in a hot room at 180°F. for one hour and thereafter standing aside at room temperature.

The rapeseed oil settled out completely in 12 hours' time.

The following mixtures were then prepared by heating the red oil to the stated temperatures with a closed steam coil, blowing with air, gradually adding the rapeseed oil and maintaining the temperature and agitation with air for the periods shown:

**Blend No. 2—15% Rapeseed Oil; 85% 250 Red Oil, Treated.**

Viscosity of blend ..... 49/210
Temperature maintained at ..... 180°F.
Viscosity of blend after 1 hour's standing ..... 49/210
Viscosity of blend after 3 hours' standing ..... 50/210
Rapeseed oil settled out on standing over night.

**Blend No. 3—15% of 1,500 Viscosity Blown Rapeseed Oil; 85% 250 Red Oil, Treated.**

Viscosity of blend ..... 65/210
Temperature maintained at ..... 180°F.
Viscosity of blend after 1 hour's blowing ..... 65/210
Rapeseed oil settled out over night.

**Blend No. 4—15% of 1,500 Viscosity Blown Rapeseed Oil; 85% 250 Red Oil, Treated.**

Blended at ..... 180°F.
Viscosity of blend after 3 hours' blowing ..... 65/210
Rapeseed oil settled out over night.

**Blend No. 5—15% of 2,000 Viscosity Blown Rapeseed Oil; 85% 250 Red Oil, Treated.**

Blended at ..... 180°F.
Viscosity of blend ..... 71/210
Blown for 3 hours at ..... 180°F.
Rapeseed oil settled out over night.

**Blend No. 6—15% of 2,000 Viscosity Blown Rapeseed Oil; 85% 300 Red Oil, Treated.**

Blended at ..... 180°F.
Viscosity of blend ..... 79/210
Viscosity of blend after blowing for 3 hours at 180° F. ..... 80/210
Settled out over night.

**Blend No. 7—15% of 2,000 Viscosity Blown Rapeseed Oil; 85% 250 Red Oil, Treated.**

Blended at ..... 230°F.
Viscosity of blend after blowing for 1½ hours at 230°F. ..... 78/210
Viscosity of blend after blowing for 1½ hours more at 250°F. ..... 74/210
Rapeseed oil settled out over night.

**Blend No. 8—15% of 2,000 Viscosity Blown Rapeseed Oil; 85% 250 Red Oil, Treated.**

The Oil was first blown at 250°F., after which the rapeseed oil at a temperature of 500°F. was slowly added. Blowing at 250°F. was continued for two hours. The mixture remained homogeneous on standing for 24 hours, but commenced to settle out after 48 hours.

**Blend No. 9—15% of 2,000 Viscosity Blown Rapeseed Oil; 85% 600 Red Oil, Treated.**

Temperature to which both oils were heated before blending ..... 150°F.
Oils were not blown.
Viscosity of blend ..... 88/210
Mixture remained perfectly homogeneous on standing.

**Blend No. 10—15% of 1,500 Viscosity Blown Rapeseed Oil; 85% 600 Red Oil, Treated.**

Temperature to which oils were heated before blending ..... 150° F.
Oils were not blown.
Viscosity of blend ..... 83/210
Mixture remained homogeneous on standing.

**Blend No. 11—12% of 1,500 Viscosity Blown Rapeseed Oil; 88% 600 Red Oil, Treated.**

Temperature to which oils were heated before blending ..... 150°F.
Oils were not blown.
Viscosity of blend ..... 77/210
Mixture remained homogeneous on standing.

Complete tests on the blended oil were as follows:

| | |
|---|---|
| Gravity, degrees A. P. I. | 19.4 |
| Flash, degrees F. | 390 |
| Fire, degrees F. | 450 |
| Viscosity at 100° F. | 958 |
| Viscosity at 210° F. | 77 |
| Cold test | Below zero |
| Color, Lovibond ¼" cell | 90 |
| Free fatty acids, per cent | 1.05 |
| Emulsion test | Completely emulsified with distilled water after standing for one hour. |

Table 2, shown below, gives still further data as to the tests on marine engine oils made with the particular oils and in the percentage proportions indicated:

TABLE 2.

*Blending for Marine Engine Oil.*

| Components | % | Grav. | Flash | Vis. 100 | Pour | Color | Acidity as Oleic | Corrosion | Vis./210 |
|---|---|---|---|---|---|---|---|---|---|
| **Compound No. 1.** | | | | | | | | | |
| Blown Rapeseed | 20 | 14.1 | 500 | ..... | 15 | 3 | 5.0 | | 700 |
| 250 Red Filtered | 80 | ..... | 420 | 244 | 30 | 3½-4 | .... | | ..... |
| Marine Engine | .... | 24.1 | 425 | 528 | –0 | 3½ | 1.1 | OK | 71.9 |
| **Compound No. 2.** | | | | | | | | | |
| Blown Rapeseed | 11 | 14.1 | 500 | ..... | 15 | 3 | 5.0 | | 700 |
| 600 Red Filtered | 89 | ..... | 400 | 604 | 25 | 6 | .... | | ..... |
| Marine Engine | .... | 20.1 | ..... | 795 | –0 | 5½-6 | 0.6 | OK | 70.6 |
| **Compound No. 3.** | | | | | | | | | |
| Blown Rapeseed | 11 | 14.1 | 500 | ..... | 15 | 3 | 5.0 | | 700 |
| 600 Red Treated | 89 | ..... | 400 | 607 | 20 | 80¼" | .... | | ..... |
| Marine Engine | .... | 20.3 | ..... | 801 | –0 | 73¼" | 0.6 | OK | 71.4 |
| **Compound No. 4.** | | | | | | | | | |
| "Ricine" (probably blown fish oil) | 18 | 11.3 | 470 | ..... | 40 | 5½ | 6.0 | S.V. 220 I.V. 64.3 | 458 |
| 600 Red Treated | 82 | ..... | 400 | 607 | 20 | 80¼" | .... | Corros'n | ..... |
| Marine Engine | .... | 19.1 | 405 | 750 | –0 | 6 | 1.1 | OK (No separation) | 70.3 |

Table 3 shows the viscosities obtained on additional blends of rapeseed and mineral oil when mixed together in various percentage proportions.

TABLE 3.

*Blends for Marine Engine Oils.*

| BLENDS: | Vis./210 | Remarks |
|---|---|---|
| 13% 1,000 viscosity rapeseed oil; 87% 600 red filtered oil | 80 | |
| 12% 1,500 viscosity rapeseed oil; 88% 600 red filtered oil | 80 | Compound at 200° F. |
| 8% 2,000 viscosity rapeseed oil; 92% 600 red filtered oil | 78 | |
| 12% 2,000 viscosity rapeseed oil; 88% 600 red filtered oil | 90 | Compound at 200° F. |

Table 4 shows the results of tests on several well-known brands of marine engine oils, together with the results of tests on the mineral oil that was separated therefrom by washing out the mineral oil as soap.

TABLE 4.

*Results of Tests on Marine Engine Oils and on Mineral Oil Used Therewith.*

| | No. 1 | | No. 2 | | No. 3 | | No. 4 | |
|---|---|---|---|---|---|---|---|---|
| | Marine Engine Oil | Mineral Oil | Marine Engine Oil | Mineral Oil | Marine Engine Oil | Mineral Oil | Marine Engine Oil | Mineral Oil |
| Gravity | 21.5 | 23.0 | 22.7 | 24.9 | 23.0 | 25.8 | 20.0 | 21.2 |
| Flash | 345 | 240 | 400 | 390 | 395 | 350 | 375 | 375 |
| Fire | 415 | 380 | 470 | 450 | 465 | 420 | ..... | 425 |
| Vis./100 | 483 | 304 | 525 | 283 | 506 | 191 | 586 | 359 |
| Vis./130 | 236 | 108 | 251 | 155 | 362 | 111 | ..... | ..... |
| Vis./210 | 65 | 50 | 72 | 55 | 73 | 52 | 67 | 52 |
| Color Lovibond | | 175-½ | | 230-½ | | 180-½ | 145-⅓" | 6 |
| Pour | 0 | 25 | 30 | 35 | 30 | 25 | –0 | 25 |
| Free fatty oil | 15.48 | | 20.38 | | 19.95 | | 26.1 | |

Marine engine oils usually contain from 10 to 30 per cent of blown rapeseed oil, the exact proportion being dependent upon the particular use to which the oil is to be placed.

# The Jamin Effect *in* Cylindrical Tubes*

*By* W. O. SMITH[1] and MILTON D. CRANE[2]

ABOUT the middle of the last century, Jamin[3] noticed that an ordinary cylindrical capillary tube filled with a chain of alternate air and water bubbles is capable of sustaining a finite pressure. If a series of constrictions is placed in the tube, the pressure sustenance is considerably increased. Each of these two effects, which might be termed the cylindrical and non-cylindrical, respectively, is referred to by Jamin's name. The writers have investigated the former, and conclude from their work that careful cleaning and avoidance of contamination render a cylindrical capillary incapable of sustaining pressure.

### *Apparatus*

The device used consisted of a cylindrical capillary about one meter long. On one end was fastened a cylindrical glass reservoir 2 cm. in diameter and 10 cm. long. An open water manometer fastened to this reservoir served to measure pressure. A second opening into the reservoir introduced water and fluids. If the reservoir is partly filled and a vacuum is applied to the end of the capillary, a chain can be quickly introduced. The apparatus is shown in Fig. 1.

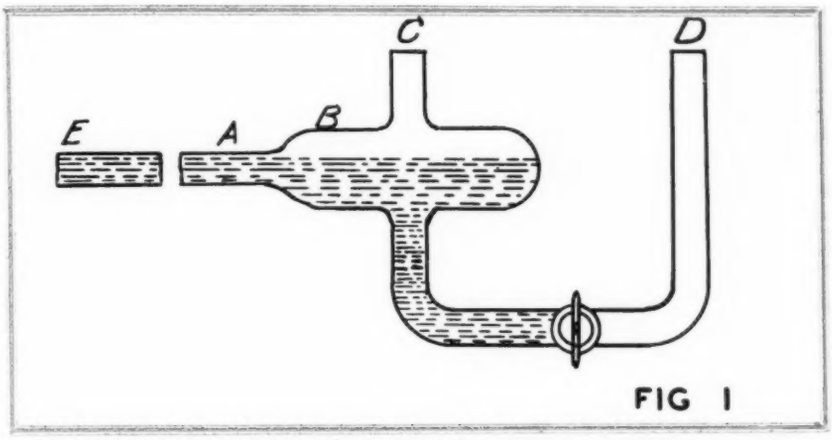


Fig. 1—Apparatus for producing Jamin chain. A, capillary; C, manometer connection; B, reservoir; D, filling connection; E, ground-glass joint for applying vacuum.

### *Experimental Procedure*

This apparatus was cleaned with hot chromic acid mixture and was finally washed out by prolonged steaming. Pure water was prepared by distillation from alkaline permanganate solution in a still constructed entirely of hard glass. Its surface tension was found to be 72.2 dynes at 24 degrees. The water was distilled directly into the reservoir described until a quantity sufficient to introduce a chain had been obtained. In general, a chain shorter than the length of the tube was used and placed so as to occupy the portion of the tube adjacent to the reservoir, the remainder of the capillary being open. While the chain was confined within the tube, no pressure could be sustained.

However, when a bubble had reached the end of the tube and had formed a meniscus over its plane surface (Fig. 2), small pressures were supported. The pressure $p$ required to overcome this end-resistance is given in order of magnitude by $p=2\pi r\sigma/\pi r^2=2\sigma/r$, where $r$ is the radius of the tube and $\sigma$ the surface tension of the water. Table I shows the observed and calculated end-pressure for chains of varying lengths. The agreement is well within the limits of error when it is remembered that the end bubble is formed partly exterior to the capillary.

After drying the inside of the tube by a stream of clean dry air, it was contaminated by being completely filled with a solution of oleic acid in benzene. The filled tube was allowed to stand from thirty minutes to one hour and was again drained and dried by a stream of clean dry air. The chain of alternate air and water bubbles was then reintroduced, with the result that the column sustained finite pressures ranging from several centimeters to over a meter of water, depending on the concentration of the oleic acid solution used. The data are tabulated in Table II. Relatively small concentrations of oleic acid were found to show a greater sustaining capability than larger ones, but the limits have not been completely investigated. The results reported seem to warrant the conclusion that there is no Jamin effect in cylindrical tubes when perfect wetting liquids are used. However, when there is only partial wetting and hysteretic contact angles are present, there will be a definite effect.

TABLE I.

*End-Resistance for Uncontaminated Tube.*

| Number of Bubbles in Tube | Length of Bubbles Air, mm. | Water, mm. | End-press., cm. of Water | Computed End-press., cm. of Water | Radius of Tube cm. |
|---|---|---|---|---|---|
| 118 | 5—10 | 2 | 2.20 | 2.72 | 0.054 |
| 92 | 4.5—7 | 1.5 | 2.25 | 2.72 | .054 |
| 108 | 4.5—9 | 1.75 | 2.22 | 2.72 | .054 |
| 120 | 5—15 | 1 | 2.00 | 2.72 | .054 |
| 106 | 4.5—10 | 1.5 | 2.20 | 2.72 | .054 |
| 110 | 4.5—10 | 1 | 2.05 | 2.72 | .054 |
| 117 | 4.5—10 | 1 | 2.05 | 2.72 | .054 |

TABLE II.

*Contaminated Tube.*

| Number of Bubbles in Tube | Length of Bubble Air, mm. | Water, mm. | Press. Obs., cm. of Water | Press. Per Bubble, cm. of Water | Radius of Tube mm. | Concn. of Contamination Soln. (Oleic Acid in Benzene), $N$ |
|---|---|---|---|---|---|---|
| 185 | 2 | 3 | 161 | 0.870 | 0.54 | 0.001 |
| 149 | 2—4 | 1 | 106 | .711 | .54 | .001 |
| 175 | 2—4 | 1 | 48.5 | .278 | .54 | .02 |
| 69 | 1—2 | 1 | 12.2 | .177 | .54 | .02 |

### *Theory.*

Let us consider a single tube containing a chain of alternate air and water bubbles. Let one end be exposed to the

Presented before the American Chemical Society.
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[2] This work was done while the junior author was a senior student in the School of Mines, University of Pittsburgh.
[3] M. J. Jamin.

atmosphere and the other be acted upon by a pressure $P$. Then, if $n$ is the number of bubbles, each designated by $i$, $r$ the radius of the tube, $\sigma$ the surface tension of the contaminated liquid, $\Theta_1$ and $\Theta_2$ the contact angles on the advancing and receding ends of a bubble, respectively, we have the following equilibrium relation for tubes which are so small that gravity effects are negligible:

$$\pi r^2 P - \sum_{1}^{n} i\, 2\pi r\, \sigma\, (\cos \Theta_2 - \cos \Theta_1) i = \pi r^2 A$$

from which

$$P = \frac{2}{r} \sum_{1}^{n} i\, \sigma\, (\cos\, \Theta_2 - \cos \Theta_1) i + A \qquad (1)$$

where $A$ is atmospheric pressure.

There are several possibilities. It is apparent that, if $\Theta_1 = \Theta_2$, including $\Theta_1 = \Theta_2 = 0$, we have $P = A$, and no finite pressure can be sustained. On the other hand, when $\Theta_1 = \Theta_2$, a finite pressure given by Equation 1 can be supported. The greatest pressure $P'$ which can be sustained is given by

$$P' = \frac{2\sigma n}{r} (\cos \Theta'_2 - \cos\, \Theta'_1) + A \quad (2)$$

where $\Theta'_2$ and $\Theta'_1$ are the extreme values which the contact angles assume. This is obviously produced by increasing the pressure $P$ until all bubbles have suffered their maximum distortion.

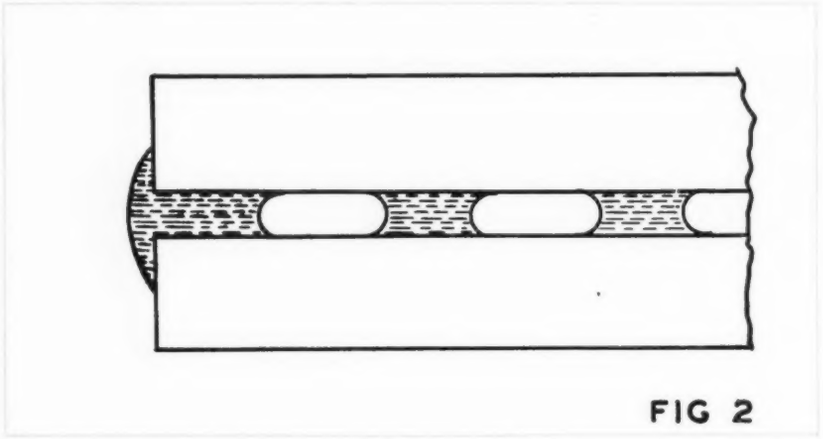



**Fig. 2—Position of bubble at end of capillary.**

Alteration of curvature radii is easily observed, although it cannot be reconciled with the Laplace curvature relation unless hysteresis of contact angles is present. The static problem of capillarity requires the finding of solutions of this equation and adapting them to a given solid boundary for a given angle of contact. If the contact angle is fixed, there is a unique solution, hence a definite curvature.

***Discussion.***

The results suggest that the hysteresis $(\Theta'_2 - \Theta'_1)$ is determined by the concentration of the contaminating substances present, a slight contamination producing a greater effect than a larger, within a certain range. Another factor, however, is to be considered. One would expect that small concentrations of the contaminating solution contain a sufficient number of molecules to be absorbed on the glass surface and leave very few to be absorbed on the water interface after introduction of the chain. Hence, the surface tension of the water is not lowered appreciably. When larger concentrations are used, there is an excess which is adsorbed on the surfaces of the water bubble, lowering its surface tension appreciably. Obviously, from Equation 1, the value of $P$ will be decreased.

In order to verify Equation 2, a detailed study should be made of the manner in which concentration of contaminating solution affects the pressure which can be supported, as well as its relation to contact angles, especially hysteresis. In addition, the variation of $\sigma$ due to the changed concentrations should be checked.

In conclusion, it must be emphasized that for the case of a non-cylindrical tube, containing a series of constrictions, a definite Jamin action must occur due to the geometrical nature of the boundary, as a simple application of the capillary equation to a completely wetted conical capillary of circular section will demonstrate.

The writers wish to thank Paul D. Foote, Irving Langmuir and W. A. Hamor for advice and suggestions during the progress of this work.

***Summary.***

Two types of Jamin effect are recognized, namely, that occurring in cylindrical tubes, and that in non-cylindrical capillaries. For the cylindrical case, the authors were unable to detect any effect when the tubes were so clean that complete wetting occurred. On contamination of the tubes with solutions of oleic acid in benzene, finite pressures could be supported. Slight contaminations have more effect than larger ones within certain limits. The results suggest that Jamin action arises in cylindrical tubes because of hysteresis of contact angles. The greatest pressure $P'$ which can be sustained is calculated to be

$$P' = \frac{2\sigma n}{r} (\cos \Theta'_2 - \cos\, \Theta'_1) + A$$

where $\Theta'_2$ and $\Theta'_1$ are the maximum and minimum values which the contact angles assume, $n$ the number of bubbles in the chain, $\sigma$ the surface tension, $r$ the radius of the tube and $A$ atmospheric pressure.

## Macpherson Gets Susquehanna Line Contract

The Susquehanna Pipe Line Company, subsidiary of the Sun Oil Company, awarded June 26th to the Macpherson Construction Company, formerly of Dallas, Tex., but now located in Philadelphia, Pa., contract for construction of gasoline pipe line system, approximately 500 miles in length, running from Marcus Hook, on the Delaware River southwest of Philadelphia, through Southern Pennsylvania and Northern Ohio to Columbia, Harrisburg, Chambersburg and Pittsburgh, Pa., Youngstown, Akron and Cleveland, Ohio, with branch north in Eastern Pennsylvania to Reading and Allentown and the steel works in that district.

This line will be welded, of 8-inch and 6-inch diameter, having a capacity of 15,000 barrels of gasoline daily, and a number of equipment camps and gangs will be installed and construction started immediately, first shipments of pipe arriving early in July.

The Macpherson Construction Company has specialized in oil and gas pipe line construction only for over twenty years past, construction having been undertaken in practically every oil and gas field throughout the United States.

## Moody-Seagraves Add to Gas Holdings

Announcement was made recently that the American Utilities & General Corporation, the Moody-Seagraves Company and the Hope Engineering Company had added more than 400,000 acres to their holdings in the eastern Kentucky gas fields, giving them more than 934,000 acres. The group reports gas reserves in this territory of 425,000,000,000 cu. ft.

*Some Observations on*

# CHARCOAL PLANT OPERATION IN ROUMANIA

*By* **M. FRENC,** ***Chemical Engineer,*** **Ploesti, Roumania**

THE relatively recent introduction of the charcoal process of gasoline extraction makes it subject to still further improvements, especially in what concerns the reduction of installation and exploitation expenses.

One of the major items of the first installation cost is the charcoal itself, while the steam plays an important role in the exploitation's expenses. We shall study here the possibilities of reducing them both.

M. Frenc

To find out the quantity of charcoal necessary for a gasoline plant for a given production, the following formula can be used:

$$Q = \frac{100\,C.}{1440} \cdot \frac{N}{S}$$

where

Q is the amount of charcoal to be determined in kg.

C is the gasoline production per day in kg.

S is the optimum saturation of the charcoal with gasoline in per cent of its own weight at a given set of conditions.

N is the duration of a complete cycle (i. e., absorption + steaming + drying and cooling) in minutes.

From all this, value—C, i. e., the daily gasoline production, is to some extent constant. S and N are in some respect at our disposition and consequently will be chosen in such a manner as to make the quotient $\frac{N}{S}$ as small as possible, to reduce the amount of charcoal, thus decreasing the first cost.

To make $\frac{N}{S}$ small, we must tend to increase the optimum saturation S and to minimize the length of the total period N.

In what concerns S we will discuss below in relation with the period of drying and cooling of the charcoal.

To establish the duration of a complete cycle N we must consider it as composed of:

1) The period of absorption.

2) The period of distilling the gasoline off the charcoal.

3) The period of drying and cooling the charcoal.

We don't consider it recommendable to give the same duration for all three periods, as is still the practice with some engineering companies.

It is a known feature that the steam consumption does not vary as much in function of the saturation of the charcoal by gasoline as it does with the duration of the distillation period itself; hence there is no reason to choose those two periods (absorption and steaming) of the same length; on the contrary, we shall make the distillation period as short as possible in relation with the absorption, thus reducing the steam consumption.

Providing the steam lines are of sufficient size, the distillation can be finished in 10 to 20 minutes. This duration permits the almost complete extraction of the gasoline off the charcoal without exaggerating the size of the steam lines.

As a consequence of the above, the absorption period will be about 1½ to 2 times longer than the distillation period. To determine it exactly, one must decide between higher charcoal cost with a longer period or a higher steam consumption and a shorter one.

The greatest care must be observed in establishing the drying and cooling period. This period depends upon the humidity and the temperature of the charcoal that one wants before beginning of the absorption and will therefore be the shorter, the higher the humidity and the temperature allowed at the end of this period.

It is well known that the absorption power of the charcoal is attained when it is as dry and cool as possible. Based on this last consideration, the drying and cooling period would have a duration as to allow it to be completely dried and cooled.

On the other side it is certain that with shorter periods one can reduce the first cost. That there exists a contradiction, or the drying and cooling period is sufficiently long to dry and cool the charcoal to the minimum, thus increasing the total period N and the charcoal quantity, or the drying and cooling period is shortened, sacrificing a little part of the absorption power of the charcoal, but realizing a shorter total

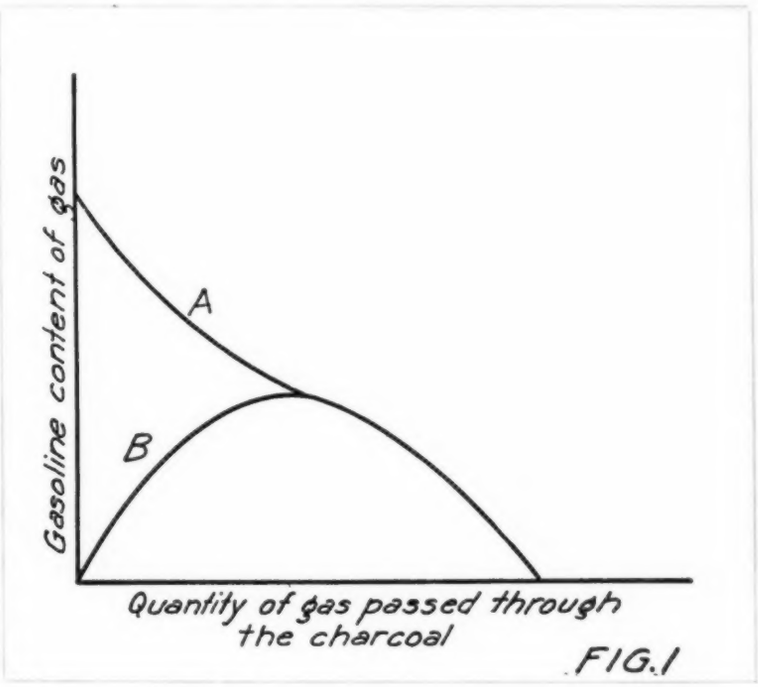
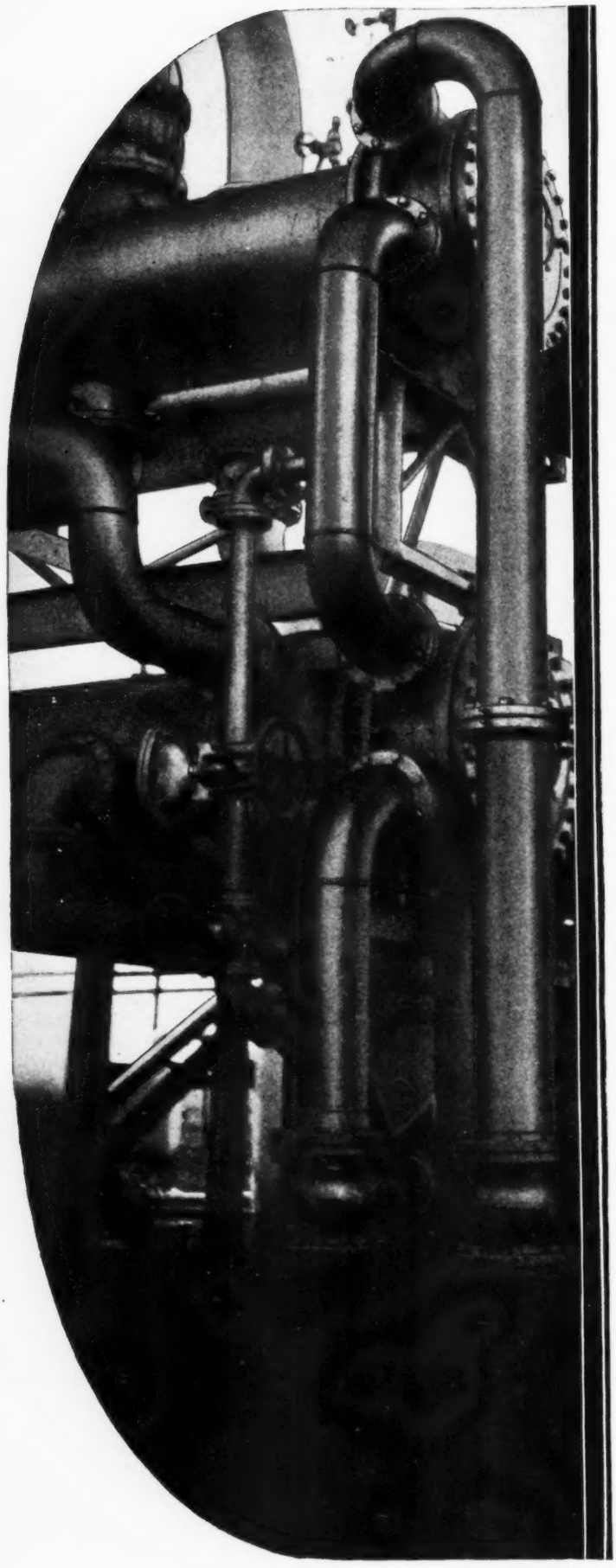



FIG. 1



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period N and, as a consequence, minimizing the charcoal quantity.

It is clear for everyone that there must exist some third factor that will decide between these two contradictory conditions and indicate how to obtain high values for S (S being the measure of the absorption power), with the charcoal remaining somewhat warm and humid.

The scope of this article is not to enter all the details; it would lead us too far, because the conditions are not the same with different kinds of charcoals and gases with variable gasoline content. We intend only to establish some general rules.

We will first define the notion of the saturation optimum.

If we weigh a quantity of charcoal before and after absorption (all precautions being taken not to allow the charcoal to absorb something other than hydrocarbons), the difference in weight divided by the quantity of gas passed through the charcoal will give the gasoline content of this gas. A quantity of gas passed through the same quantity of charcoal increases its gasoline content, because the charcoal does not absorb proportionally to the quantity of gas passed. This can be represented graphically by the curve A, Fig. 1.

If the quantities of charcoal charged with increasing gasoline quantities are distilled under identical conditions, a gasoline amount is obtained each time that will be the nearer to the increase in weight of the charcoal caused by the absorption.

Checking the gasoline thus distilled to the gas passed, one has the effective gasoline content of this gas. Graphically, this last result will be represented by the curve, B. The saturation that corresponds to the point where both curves meet is the saturation optimum for a given set of conditions. A higher saturation will cause losses of gasoline with the dry gases during the absorption; a lower saturation signifies losses during the distillation because of the light part remaining in the charcoal. One tends to work with rather lower saturation than the optimum, the distillation losses being recuperated by a recompressor or by reintroducing the condenser tail gases in the charcoal with the wet gas.

After establishing the notion of the saturation optimum, we will try, in order to determine this value, to make clear what happens during the absorption of gasoline in somewhat humid and warm charcoal.

The humidity, as pointed out above, decreases considerably the absorption power of the charcoal for gasoline vapors, but does not in the same degree for all its constituents. A gasoline resulting from a wet charcoal has a higher specific gravity than a gasoline made with a dry one. This proves that the lighter constituents are less absorbed in wet charcoal, at least at the beginning (all other conditions during that time being the same). If the wet charcoal has also a somewhat higher temperature, the phenomenon of absorption changes its character, Generally speaking, with higher temperatures the activity of the charcoal diminishes with wet charcoal. This anomaly has the following explanation: The first parts of gas passing the wet and hot charcoal draw along a part of its humidity and heat, thus increasing the activity in a measure that surpasses the loss in activity that would cause the actually high temperature. The next rich parts met more active charcoal, which retains the gasoline (giving up) another part of its humidity, and so on up to the moment where the optimum saturation corresponding to some initial humidity and temperature is attained. The higher the initial temperature of the charcoal, the larger will be the humidity entrained by the gas (the initial humidity being the same) and the higher will be the optimum saturation, arriving, as well understood, at a maximum, after which it will decrease with still higher temperature the loss of activity caused by this being no more counterbalanced by the gain in activity due to the drying effect of the gas.

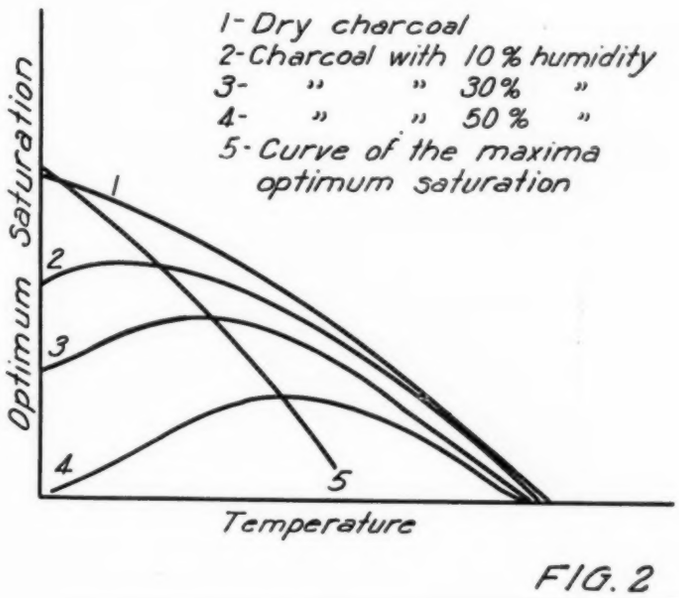


FIG. 2

Graphically, the whole will be represented by Fig. 2.

It is well understood that the activity of wet and hot charcoal will never attain the values of dry and cool charcoal, but it is of little importance, because the values of wet charcoal permit the quotient N/S to be so little as to reduce the charcoal amount to the half of that employed in first installation of this sort without interfering with the capacity of the installation.

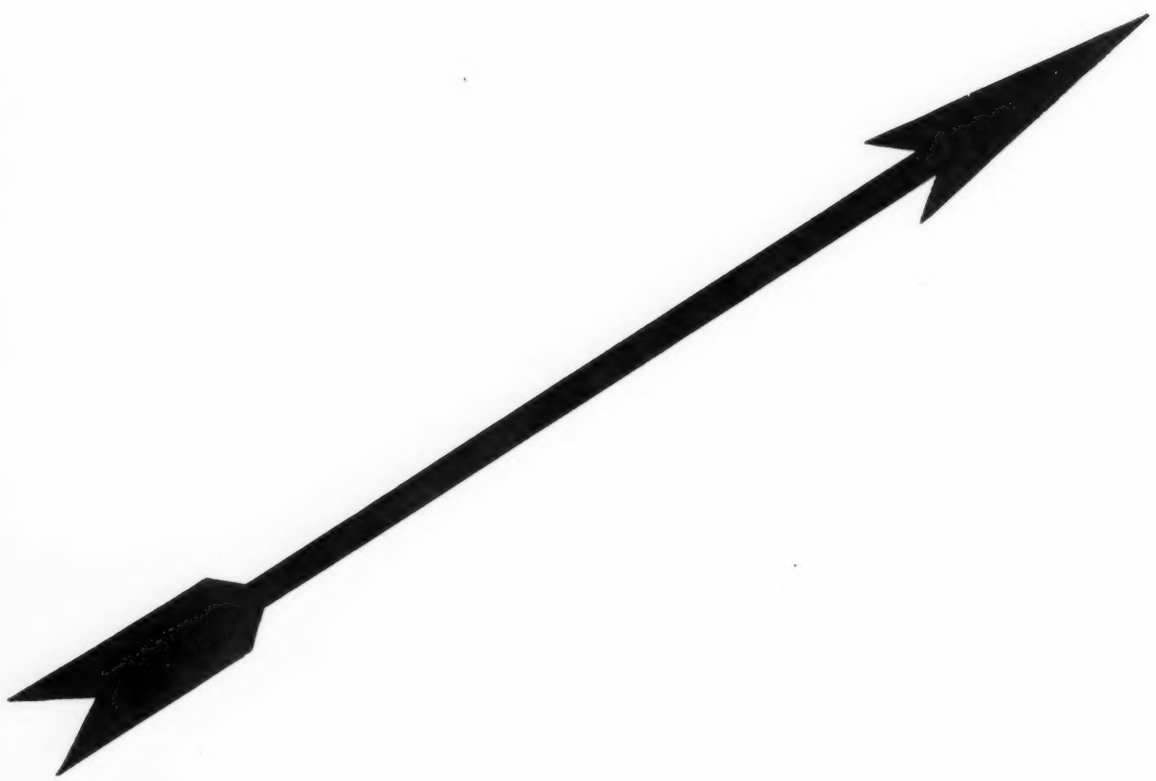
Care must be taken not to force the charcoal and to reduce too much the period of drying and cooling; this circumstance forces us to work with too little values of S, making not only N/S too high but causing also a shorter absorption period in comparison with the distillation, thus increasing the steam consumption.

---

## Summer Courses in Refining at Boston Tech.

Two special courses in petroleum refining will be offered at the summer session at the Massachusetts Institute of Technology from July 7th to August 9th, 1930. The first of these is: Dynamics of Fluids and Flow of Heat by Dr. T. K. Sherwood, and the second, Distillation, Rectification and Absorption by Dr. W. K. Lewis.

The work is planned primarily to meet the needs of technical men in the petroleum industry, particularly young men, who, though possessing a sound engineering and chemical background, lack specialized training in the fundamentals of fluid dynamics, flow of heat, and the mechanism of interaction of phases. Registration for the work will be limited to men with adequate training along engineering and chemical lines.



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# Texas Gasoline Plant Has Unusual Features

IN order to increase the plant efficiency and to manufacture grade AA natural gasoline, the National Supply Co.'s plant near Lela, Texas, has recently completed an extensive improvement program under the supervision of E. C. Smith, plant superintendent. The capacity of the plant is 22,000,000 cubic feet per day, and from ten to twelve thousand gallons of gasoline are manufactured.

The two absorbers are operated under a pressure of 28 to 30 pounds. All of the gasoline is stabilized to grade AA. The stabilizers operated under 200 pounds pressure, with a kettle temperature about 260 degrees F.

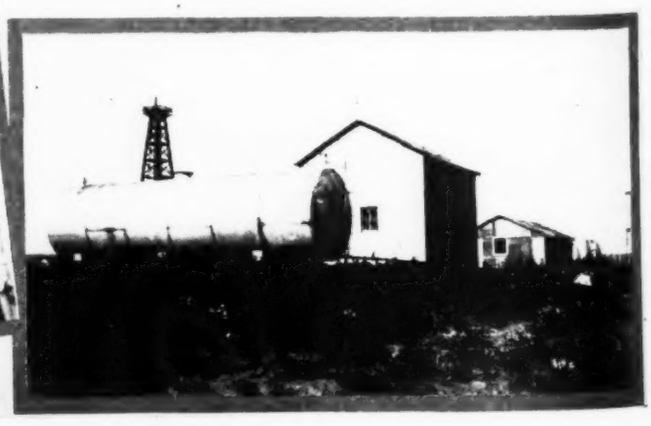
### *Sweetening Plant*

The gasoline is sweetened in a continuous treating plant in a closed system designed by the plant superintendent. Calcium hypochlorite solution is used as the reagent. The gasoline under pressure passes through a steam jet and draws the treating solution with it through a series of contacting coils (96 feet of 2-inch pipe) and then enters a settling tower, from which the spent solution is drawn off. From the settling tower the gasoline enters the wash water tower. The treated gasoline passes the doctor and corrosion tests.

The average gasoline content of the incoming gas is 0.55 gallons per thousand cubic feet. Most of the stripped gas from the plant goes to the carbon black plants located nearby. The pressure on this line is about 15 pounds.

The water for the plant is obtained from two wells. In order to economize on water, all of the condensate in the plant is collected in a specially designed system. The steam is condensed by a spray of well water which is always at 40 degrees F. The boiler feed water is softened in a treater. Since the system has been installed it is necessary to wash boilers only once a month.

The plant has a storage capacity for 80,000 gallons of gasoline. It is loaded about ten miles from the plant through a two-inch line. The working pressure on the line is about 450 pounds, and about four and one-half hours are required to load a car.



**Left to right, from top to bottom: (1) Stabilizer. (2) Boiler feed water heaters. (3) Distillation unit. (4) Boiler house. (5) Absorbers. (6) Temperature Controller. (7) Cooling tower. (8) Treating plant.**

# A Wrench That "*Grew Up*" in the Oil Fields

**IT is probably a fact that there isn't a man alive today who has worked on a rig or a pipe line who doesn't know the TRIMO pipe wrench. And it is equally probable that no wrench manufacturer has given more careful study to oil field needs than the makers of TRIMO.**

**The TRIMO pipe wrench has always been made with oil worker's needs in view. His demand for long service dictated the replaceable jaws. His demand for great strength dictated the heat treated, drop forged steel handle.**

**All Steel TRIMO is the oil man's wrench—it happens to be the best pipe wrench for a dozen other uses, but in the oil fields it is the best bet because it was purposely and deliberately made that way.**

# TRIMO Pipe Wrench

***All Steel - Drop Forged Handle - Replaceable Jaws***

**Made from jaw to handle by Trimont Mfg. Co., Roxbury, Mass.**

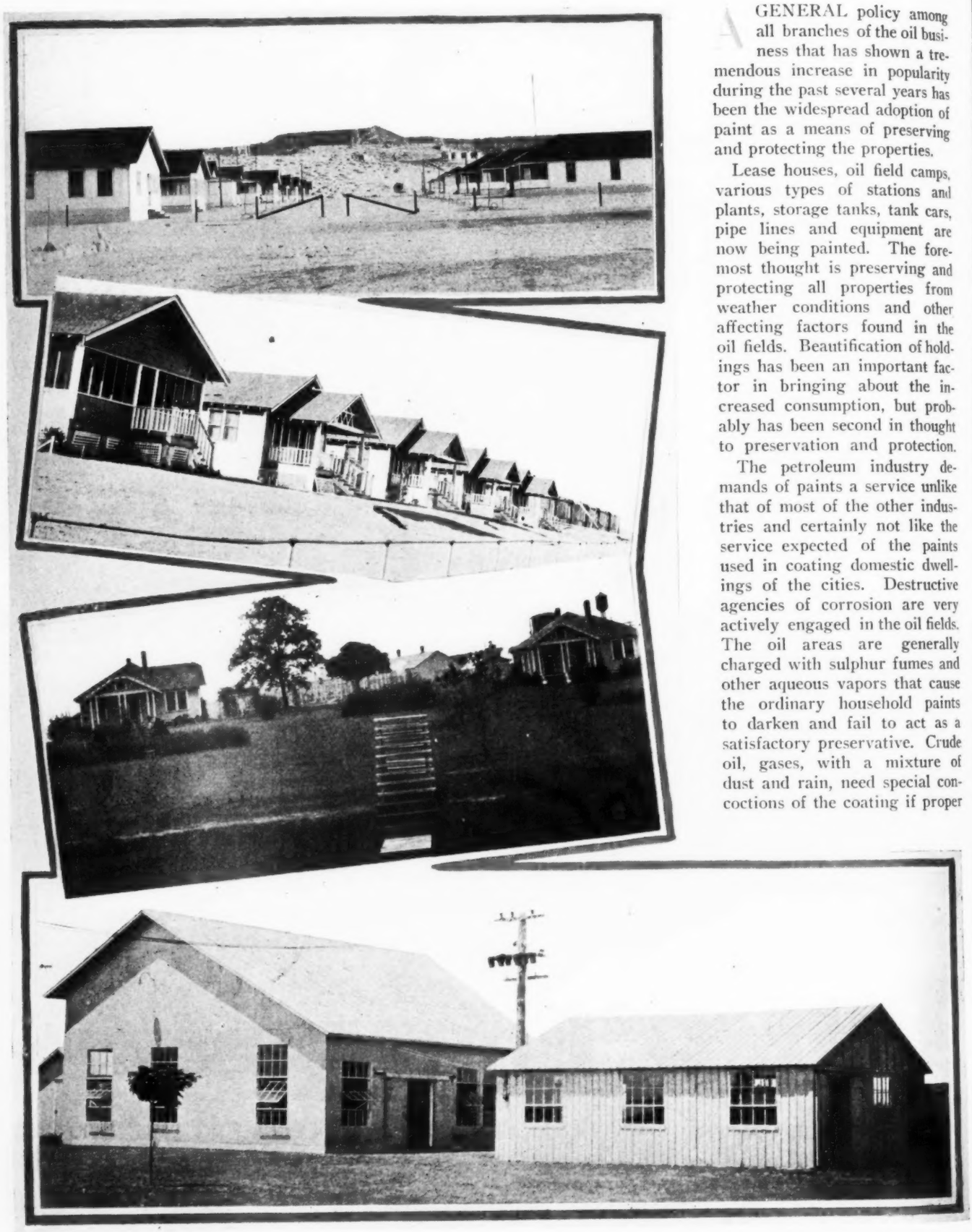
# *The Use and Application of* Petroleum Industry Paints

*By* WARREN L. BAKER

A GENERAL policy among all branches of the oil business that has shown a tremendous increase in popularity during the past several years has been the widespread adoption of paint as a means of preserving and protecting the properties.

Lease houses, oil field camps, various types of stations and plants, storage tanks, tank cars, pipe lines and equipment are now being painted. The foremost thought is preserving and protecting all properties from weather conditions and other affecting factors found in the oil fields. Beautification of holdings has been an important factor in bringing about the increased consumption, but probably has been second in thought to preservation and protection.

The petroleum industry demands of paints a service unlike that of most of the other industries and certainly not like the service expected of the paints used in coating domestic dwellings of the cities. Destructive agencies of corrosion are very actively engaged in the oil fields. The oil areas are generally charged with sulphur fumes and other aqueous vapors that cause the ordinary household paints to darken and fail to act as a satisfactory preservative. Crude oil, gases, with a mixture of dust and rain, need special concoctions of the coating if proper



Top to bottom: A West Texas oil field camp; a company camp in the field; a neat oil field camp (note the lawn); view of a neatly kept station.

results are to be obtained. Paint technologists have for several years spent considerable time and thought toward the development of paints that would satisfactorily serve the needs of the oil industry. There are many special preparations now on the market, several of which were developed to overcome some specific condition or conditions found in the different branches of the oil business.

The general demands from oil field consumers of paints are as follows:

1—Durability.
2—Good surface for repainting.
3—Appearance.
4—Resistance to hydrogen sulphide, and other fumes of the oil fields.
5—Good color-holding qualities.

If satisfaction is to be obtained, much care must be used in the application of the coats and a proper mixture of all substances in the paint secured. The successful application of paint depends largely upon four main factors, as follows:

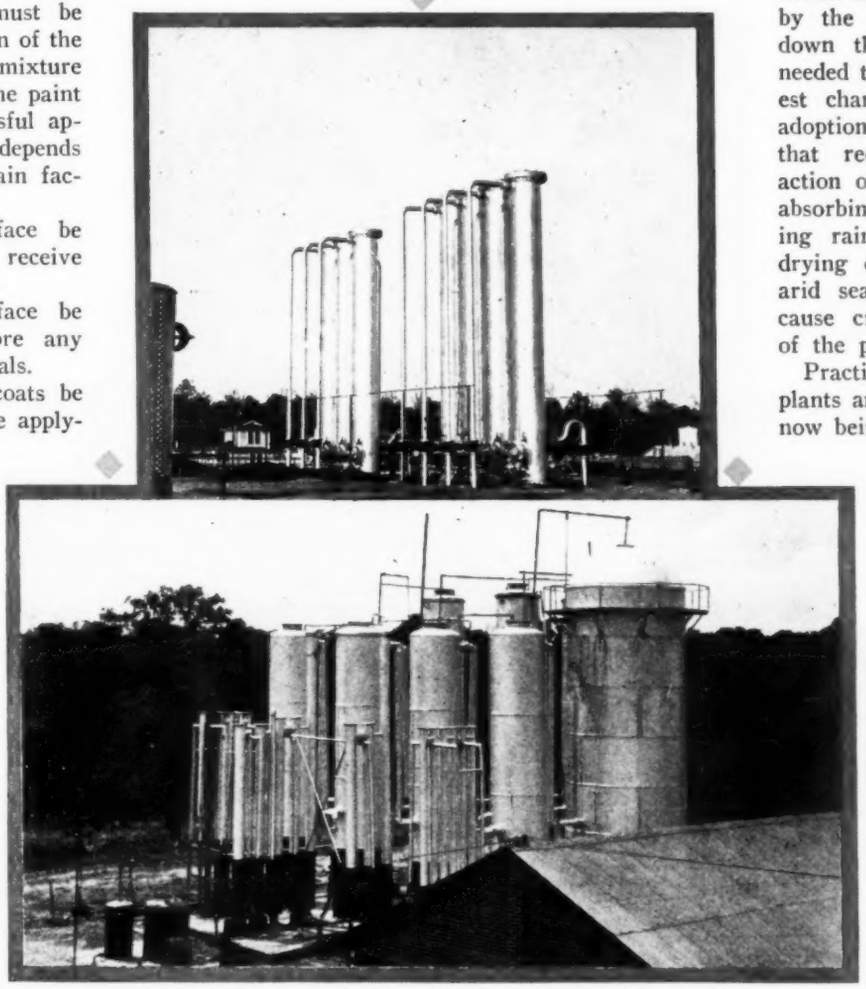
1—That the surface be properly prepared to receive the coating.

2—That the surface be thoroughly dry before any application of materials.

3—That all undercoats be thoroughly dry before applying any succeeding coats.

4—That each successive coat be of proper structure and be properly and uniformly applied to fulfill the purpose for which it is intended.

A practice, now widespread, that was not used a few years ago is the painting of oil field camps or lease houses. There will be found in practically every oil field today neatly painted houses for the employes. The camps of yesterday have been painted and the newly erected are painted at once under modern customs, and the old shabby, run-down appearance of company dwellings in the oil fields has disappeared.



Top—Aluminum-coated absorbers at Magnolia Petroleum Co., Sarepta, La., natural gasoline plant. Bottom—Light oil treating plant at Johnson Oil Refining Co., Cleveland, Okla., coated with aluminum paint.

Many of the oil companies have adopted a uniform color system for all their field camps and plants. This practice makes it easy to distinguish between the various company camps.

It is not an uncommon practice for employes of different companies to vie with each other for the most beautifully kept camp, or even for the employes of the same company to compete with others in different localities. Many of the oil field camps are pictures of beauty and neatness, as well as being modern in design and structure.

The basic principle in painting dwellings in the oil fields is similar to that of painting the modern city home. The surface must be clean and free from dirt and dampness before the primary coat is applied, and each preceding coat must be dry before the succeeding coat is applied. The paint itself must be composed of such materials as to meet the general demands listed previously in this article. Spray guns are frequently used in application of the coatings, but for a paint to be popular it must also be easy to apply with the brush.

The latest developments in the use of paints have been the improvements made in the substances of the priming coats. The priming coat formerly was one containing sufficient oil that when absorbed by the wood it would cut down the amount of paint needed to cover it. The latest changes have been the adoption of special primers that reduce the breathing action of wood; that is, the absorbing of moisture during rainy weather and the drying of the wood during arid seasons, which actions cause cracking and peeling of the paint.

Practically all gasoline plants and pump stations are now being coated. A special waterproof liquid, resisting oil, grease and water, is needed here. Even the concrete floors in these stations are being painted, in which cases, in addition to the above qualifications, it is necessary that the paint be resistant to wear.

When painting concrete floors all surfaces should be dry, clean and free from dirt and loose particles. Loose mortar should be removed and cavities and damaged spots repaired and allowed to dry thoroughly before applying the primary coat.

Concrete that has been subjected to outside exposure for several months, and even concrete on the inside, may be tested to determine the presence of free alkali by using a small quantity of a solution made as follows: One dram phenolphthalein, four ounces of grain alcohol, and one quart of water. Dip a glass rod or piece of glass into the solution and touch the surface in question. If this application results in a bright red color, the cement should be neutralized chemically by the application of three pounds of zinc sulphate crystals and one gallon of water.

# THE SOUTHWEST can now have its piping fabricated at home

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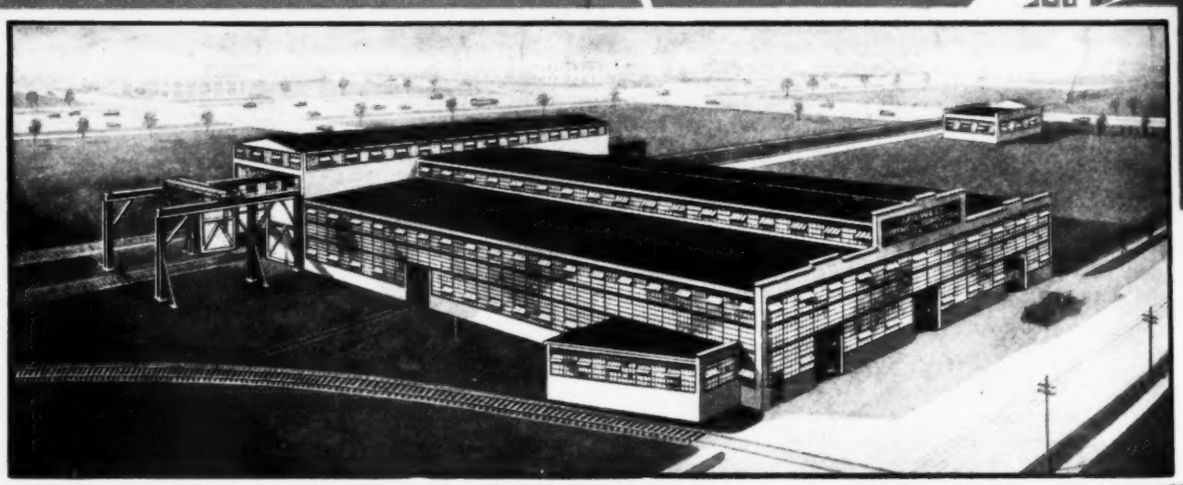

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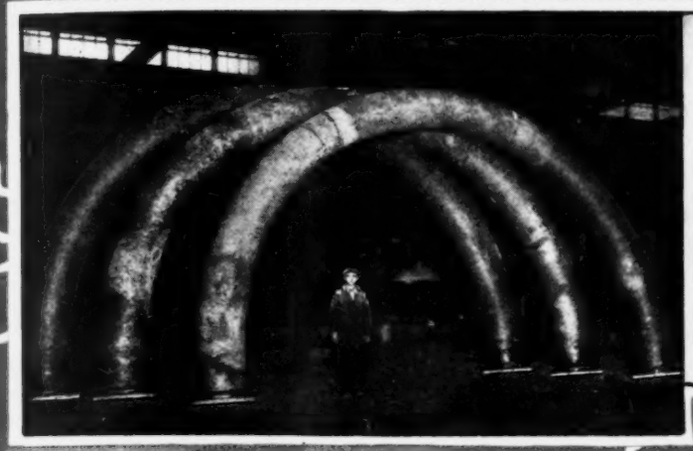

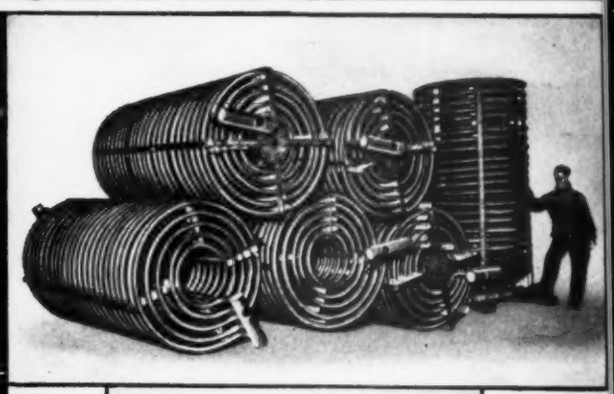

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The new Houston plant of Midwest is prepared to fabricate the piping that is required by the Southwest—complete piping for oil refineries, central stations and industrial plants—individual pipe bends, welded headers and pipe coils.

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And the key men in the Houston organization were drawn from the other Midwest plants.

Users of fabricated piping in the East, the Middlewest and on the Pacific Coast also benefit from the addition of the Houston plant, for it enables all the Midwest plants to offer the obvious advantages and economies of operating on an even larger scale.★

It is now more advantageous than ever before to get in touch with the nearest Midwest office when fabricated piping is required.

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# PIPING SERVICE

When painting metal surfaces, such as storage tanks, etc., great care must be given to the priming coat. It should be fortified by a constituency that will invest the system with the maximum rust inhibitive and anti-corrosive properties, imparting at the same time the greatest durability over a long period of time.

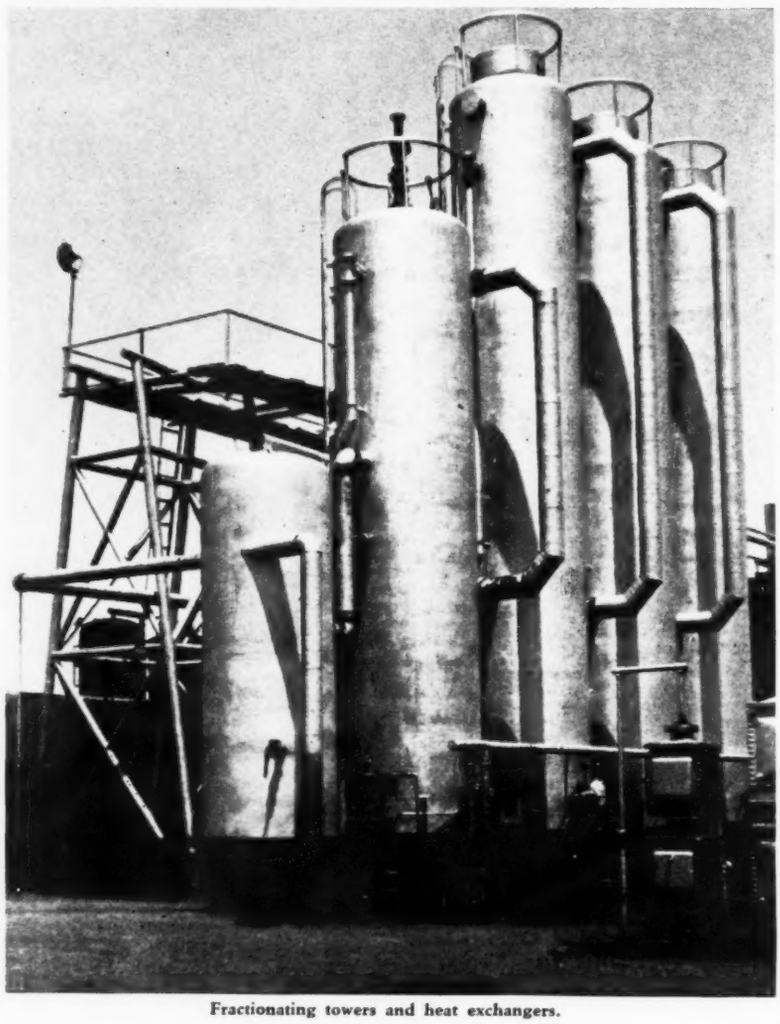
The characteristics of a metal primer usually required by the petroleum industry are as follows:

1. It must be anti-corrosive.
2. Be rust inhibitive.
3. Suitable for either brush or spray application.
4. Furnish suitable bonding surface for finishing coats.
5. Neutral in color.
6. Lie close to the metal in a continuity of film.
7. Set up in from four to six hours.
8. Dry from 18 to 24 hours.
9. Flow smoothly under the brush, insuring maximum ease of application.

At all times it must be remembered that the preparation of the surface for painting is almost as important as the paint itself. Paint that does not properly adhere will offer little or no protection to the surface beneath. Therefore it is essential that the surface be clean.

Iron and steel are generally painted to protect from corrosion. If the surface is free from rust, dust and grease or any loosely adherent material, it is ready for priming. In the preparation of metal surfaces for painting all rust should be first removed by wire brush, scraper or sand blast. All grease and oil should be removed with gasoline. No paint should be applied until the metal is thoroughly dry. This applies to all structural steel, corrugated iron, galvanized iron and steel tanks, etc. All new galvanized iron should first be cleaned with gasoline to remove all grease and foreign matter. Because of the character of the surface of galvanized iron, when new, proper adhesion of paint is prevented. A well-known treatment is to wash the surface with a solution of eight ounces of copper acetate or copper sulfate to a gallon of warm water.

An Oklahoma tank farm. Tanks covered with aluminum paint.



Fractionating towers and heat exchangers.

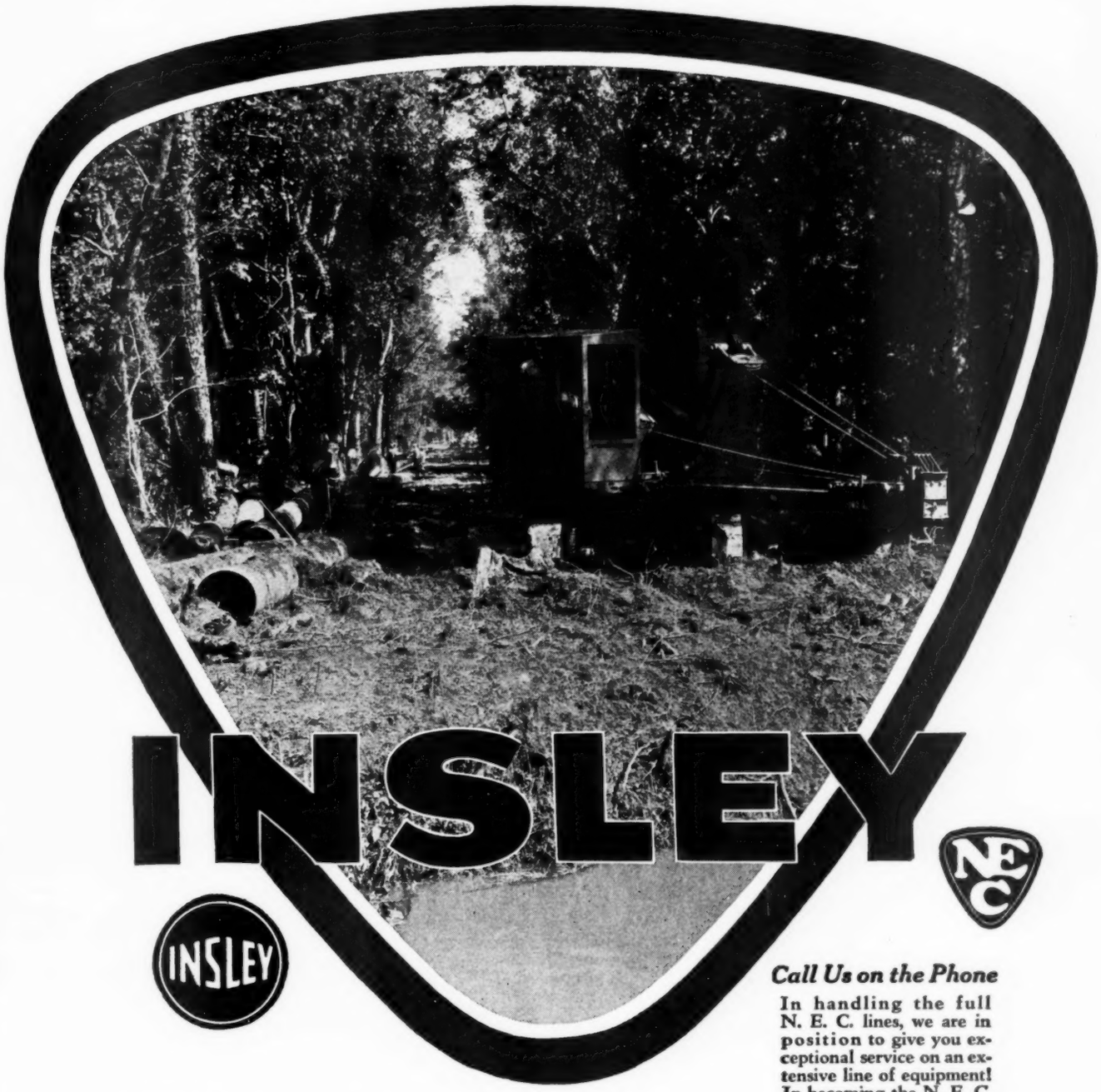
There are several paints now used as protecting for underground pipe lines. Such buried lines are often subjected to the action of soluble substances derived from the soil that causes corrosion. It is necessary for paints applied to pipe lines to be easy to apply, quick to dry, and resistant to corrosive chemical actions.

In the past few years there has been a remarkable adoption of aluminum paint by the oil companies. A visit to gasoline plants, refineries and other stations will show an abundant use of this paint. This is not the only place it is used, however, as many tank cars, steel storage tanks, and other equipment are covered with it.

The aluminum paint has many properties that have caused it to be used widely. Its bright silvery color is an obvious characteristic. Its non-transparency is an outstanding value. One coat properly applied will hide almost any surface. For this reason it is being used for priming to wood surfaces. It completely checks the breathing action of wood surfaces previously mentioned.

The application of aluminum is very similar to that of regular paint, but a very important item is the securing of a proper vehicle to be mixed with it for the particular job.

The widespread use of paints in the petroleum industry has proven quite beneficial. A painting coat at the time of erection is not considered sufficient any longer, but buildings are repainted whenever it is deemed necessary.

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# *The Use of Straightening Vanes in* Orifice Meter Measurement[1]

By WM. L. COWAN[2]

THIS article is written primarily to illustrate when and where straightening vanes should be used as well as to show the kinds of vanes available, their approved dimensions and the methods of installing them.

A straightening vane is just what its name implies it to be; a device inserted in a pipe to straighten out the flow of fluid passing through the pipe. The so-called vanes are merely equal lengths of tubing or sheet iron placed inside of a pipe in such a form that the pipe cross-section becomes honeycombed for a short distance, this distance, or length of vane being proportional to the size of the opening in the vane and these openings in turn being proportional to pipe diameter. These vanes should be, in nearly all cases, installed prior to the orifice plate, that is on the upstream side of the plate. They are installed at this point so that any distortion, swirls, eddies or other non-streamline action of the fluid in the line can be changed into a nearly true streamline flow before the fluid in the pipe reaches the orifice or upstream tap connections.

The expression "streamline flow" is at times not always clearly understood. Its true meaning is that in streamline flow all particles of the fluid, in a straight run of pipe, are moving in the same direction that is parallel to the axis of the pipe, but not necessarily at the same speeds. As has been determined by pitot tube tests, the velocities over a cross-sectional area at right angles to the axis of the pipe, vary considerably. Near the edge or surface of the pipe the velocities are low while at the center of the pipe they are relatively high. A curve of the variation in velocities taken over any diameter of the pipe in true streamline flow is somewhat parabolic in form as is shown in Figure 1.

To make clear the need of straightening vanes in certain meter runs where gases or liquids are to be measured by a thin plate orfice (or Venturi tube), a few of the absolute requisites of fluid flow conditions before, at, and after the orifice must be clearly understood. The few factors entering into the calculation of flow might also be reviewed as well as the numerous conditions affecting these items. The formula generally used commercially is basically:

Volume = CAV Cu. ft. per sec. at line conditions, or

Volume = $CA\sqrt{2gH}$ Cu. ft. per sec. at line conditions, where

A = Area of orifice in square feet.

g = Acceleration due to gravity of the earth in ft./sec./sec.

V = Velocity of fluid at its smallest cross-section in feet/sec. (Approximately true in case of flange taps, but not true in case of pipe taps.)

H = Change in pressure between the upstream pressure tap and the downstream pressure tap over the orifice, the above pressure change representing the differential head (velocity head for flange taps or pressure loss for pipe taps), measured in feet head of the flowing fluid. It is primarily dependent upon the location of the pressure taps with reference to the orifice.

C = An experimental factor or coefficient which in the case of flange taps is principally a correction for the actual area of the flowing fluid at its point of greatest velocity or (vena contracta), which is a short distance downstream from the orifice, compared to the actual area of the orifice which was used in the calculations.

In the case of pipe taps (2½ diameter upstream and 8 diameter downstream), it is chiefly an experimental factor which varies with diameter ratios (and possibly slightly with pipe sizes), and is based primarily upon the rate of pressure loss in the line due to the orifice.

This factor C also corrects, to some extent at least, for the pressure head due to the velocity of approach in the pipe line at the upstream tap. Values of this C or $C_v$ are available in almost any handbook for either system of taps and for nearly all the workable ratios of orifice diameter (d) to line diameter (D).

This factor $C_v$ is not a true constant for any given ratio of (d/D) as is often assumed, for it varies with changing flow rates which cause changing areas of vena contracta, and also changes in the velocity of approach as well as causing increasing errors due to the use of erroneous fluid densities in the cases of gases or vapors where either the upstream or the downstream pressure is used. For extremely low or extremely high flow rates these values of $C_v$ will not hold at all nor will they hold for viscous fluids. In the latter cases additional correction factors are needed.

From these various factors entering into the computation of the true flow it is apparent that the effect of these many items will often have a different effect on flange tap connections (approximate vena contracta), compared to pipe tap connections (approximate full flow). This is, of course, due to the different locations of these taps with reference to the orifice and also the fact that in flange tap connections downstream pressures are used, while in pipe tap connections upstream connections are used.

***This article is written under the auspices of the Metering Committee of the California Natural Gasoline Association and has been partially read before them, as well as sponsored by them.***

***Acknowledgment is hereby given to Mr. Huff, the Chairman of this Committee, members of this Committee, as well as other members of this Association, and numerous others outside the Association, all of whom have contributed valuable data, ideas, and criticism to this report. Especial acknowledgment might also be given to Dr. Pean of the U. S. Bureau of Standards from whose article on this subject much of the basis for this paper has been taken.***

***It might be mentioned that each member of this Metering Committee has been assigned some special subject in regards to fluid measurements and a number of very interesting papers on various phases of this subject by members of this Committee will soon be available. Being a member of this Committee it so happened that the subject given me to report upon was that of Straightening Vanes, which report is presented here.***

***WM. L. COWAN.***

[1] Report to Metering Committee—Read at meeting of California National Gasoline Association.

[2] Union Oil Co. of California.

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However, if differentials are not run too high or too low in comparison to the initial upstream pressure, that is if the ratio of $P_2/P_1$ absolute pressures is never allowed to become greater than 0.995 nor less than 0.95 then this value of $C_v$ as generally used might be considered fairly constant for most all work within a reasonable degree of accuracy.

It must also be remembered that the determination of

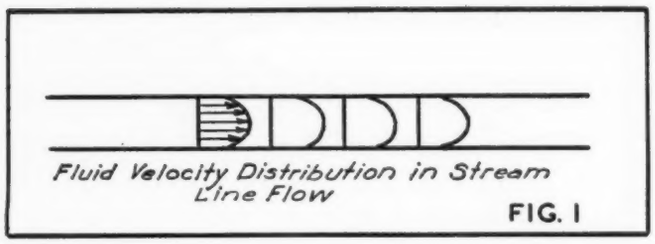

FIG. 1

this average value of $C_v$ generally adopted was found by experimentation and that in these experiments the gas was flowing to and through the orifice in as near a streamline flow as it was then possible to obtain. Naturally, if the same sort of flow as that which was used in arriving at the original coefficients is not being obtained in a line through which the gas is being metered, the experimental value of $C_v$ for this (d/D) ratio would not indicate the same amount of flow through the orifice unless there might just happen to be a combination of compensating errors.

The point which should be stressed is that if the streamline effect is not carried out exactly as in standard experimental tests, the differentials obtained will not be comparable to the standardized data, for the same differential in one case may not indicate the same volume as in the other case even though the pressures read were identical.

Not only will the differential obtained be wrong, but the pressure will possibly be incomparable to test results. In other words, to obtain correct flow through an orifice plate the conditions at the point of measurement must be identical to the conditions occurring in the original experimental tests.

Figure 2 indicates still further just what is meant by streamline flow as it effects the flow of the fluid passing through an orifice in a pipe line.

From this diagram it is apparent that the upstream pipe tap pressure ($P_1$-P.T.) is an indication of actual effective pressure in the line ahead of the orifice while the downstream pipe tap pressure ($P_2$-P.T.) is supposedly at a point where the pressure in the line downstream from the orifice has again attained its full line pressure; that is a pressure which is less than the upstream pressure by the actual effective pressure loss across the plate. In other words,

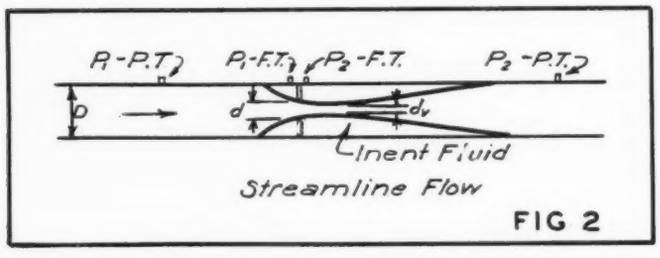

FIG 2

the streamline flow at ($P_2$-P.T.) has again filled the pipe uniformly.

It has been found by experimentation that the smaller the ratio of (d/D) the further away from the orifice will it take for the gas in the line to attain its full pressure or as can easily be seen, the nearer the orifice size comes to the internal size of the line, the quicker the recovery will be and consequently it will give less pressure loss over the plate for any given flow of gas. See Figures 3 and 4.

At the orifice itself where flange taps are used, it can be seen that the gas as it passes through the orifice, Figure 2 (streamline flow), contracts in flow to an area of diameter ($d_v$) where a great portion of the energy of the fluid is converted into kinetic or energy of velocity, thus using up a definite amount of its static or pressure energy. This point of lowered pressure is close to where the pressure tap on the downstream side is taken off. Thus it is seen why the coefficient of discharge is primarily needed in this case. From Figures 3 and 4 it is also apparent that as the ratio of (d/D) increases the ratio of the contraction of the jet to the orifice ($d_v$/d) also becomes larger while, however, the effect of the velocity of approach increases. It is evident that as (d/D) approaches one the velocity of approach also approaches the velocity through the orifice which indicates quite clearly why the $C_v$ formula does not hold for these higher ratios especially as any small variations in pipe surface becomes of exceptional importance at this point.

The true location of the vena contracta is variable, depending on the (d/D) ratio and flow or differential. Its location can be seen rather generally from the curve shown, Figure 5, taken from an article by Spitzglass, published in Mechanical Engineering.

Although this paper does not deal with pulsation effects, it might be well to point out a few of the possibilities of errors due to this cause. During a complete pulsation

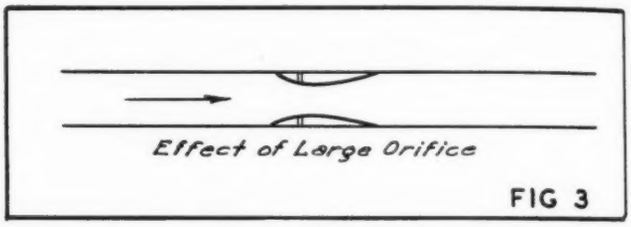

FIG 3

cycle it is possible that very many different conditions exist. At times the flow through the orifice resembles a rounded nozzle where the vena contracta is large, while at other times it may be directly the opposite, that is extreme contraction of the jet. At times of the cycle the flow might be bumping against counter currents or even flowing backward through the orifice in extreme cases. Often these pulsation effects might counterbalance one another, but at other times they may not, which is probably more often the case. In case of pulsation the results obtained must surely be of extremely doubtful character if not checked closely against other meters. Pulsation depends a great deal upon the number of cylinders or engines pumping into the line, the R. P. M., the capacity of the lines and sizes of special capacity chambers and also whether there is any pressure drop in the line due to valves, etc.

There are numerous methods of reducing pulsation, but the most effective ones utilize pressure drop or capacity with special baffle arrangement. If the pulsations are of short enough duration, specially controlled diagonal piping would be effective, but when these pulsations are rather long they do not as a rule have capacity enough to be of much value.

From the above it is clear that without reducing pulsation in the line itself the computed volumes by the differentials and pressures recorded will probably be erroneous no matter how even the chart markings might indicate due to meter dampening devices and even though the meter dampening device does give a true average differential. If straightening vanes are put in to eliminate pulsation they should be espe-

cially designed to give some effective pressure drop, for otherwise they would be of little value.

It is necessary, of course, in the case of pulsation, to place the line pulsation dampening device used between the meter and the source of pulsation. It might be suggested that in liquid measurements gas or air chambers are often found to be of great value.

The following formula given in an article by Mr. Hodgson in "Transactions of the American Society of Mechanical Engineers," 1929, indicates the error may be decreased or eliminated by increasing the volume of resistance between the source of pulsation and the meter, and generally the effect can be eliminated when

$$HV^2 > \frac{60{,}000\ P\ D^2}{R^2\ d^2} \text{ in which}$$

H = resistance in pounds between the source and the meter.

V = volume in cubic feet between the source and the meter.

P = line pressure in pounds per square inch absolute.

R = revolutions per minute (total).

d = diameter of orifice in inches.

D = diameter of the pipe in inches.

In addition to swirls and pulsations there are other conditions that occur which cause exceptionally poor flow conditions. But two or three of these will now be briefly mentioned as later on in this report a few other cases taken

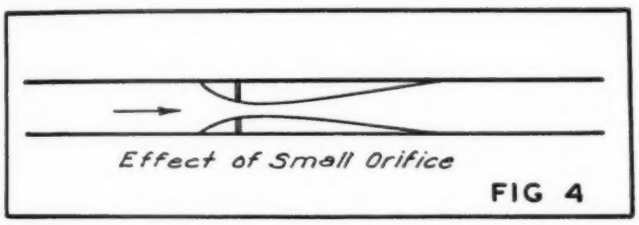

FIG 4

from actual metering conditions will be described where straightening vanes have really proven helpful.

Consider, for example, a gate valve which is only partially open, such that there is a drop of pressure across it. It is apparent that the gas will sweep on down past the valve along the one side of the pipe (Figure 6) at a high velocity which also undoubtedly sets up eddies and counter currents toward the top of the pipe. It is also apparent that the greater the pressure drop over the valve the greater will the gas velocity be on its downstream side. This latter usually occurs when the valve is just cracked. Naturally, in such cases as the above, it is certain that calculations of flow by ordinary methods for any orifice placed near such a condition as this is liable to give anything but the correct result. It is also easily seen that a vane placed too close to such an unevenly distributed flow would be of little benefit for the gas could have such a velocity that most of the gas would speed through the lower side of the vane, thus making the vane only partially effective. At these high velocities, however, the vanes are probably crowded and the gas builds up enough on its upstream side to distribute the flow perceptibly even when placed four or five diameters away from the valve or disturbance.

The above example illustrated only a gate valve, but the same general principles hold true for other types of disturbances even where the valve opening is in the center, etc. If vanes are placed the recommended distance from such a disturbance they will eliminate this error.

There might also be cases in exceptionally poorly located lines prior to a meter run which somewhat approximate the effect of baffles such as two partially opened valves which

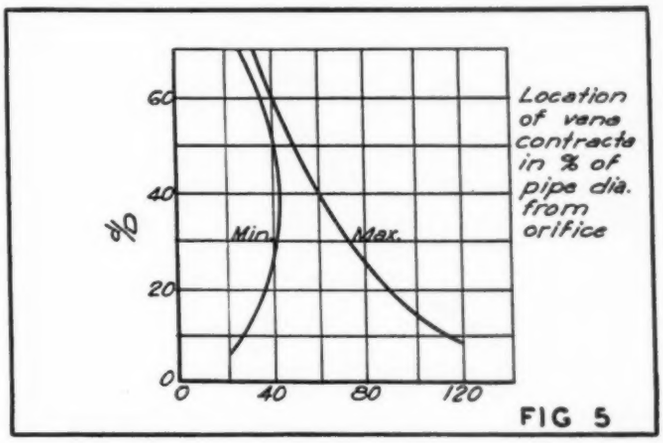

FIG 5

have openings on opposite sides of the line. The inaccuracy of such a hook-up, without vanes, is so apparent that it will not be discussed. Figure 7 indicates to some extent just what sort of flow might be expected in such a case.

No one case of this type will probably coincide with another, due to the variable rates of flow, the size of bends and openings as well as pressure drops, etc. There are, of course, many other sorts of elbow connections or pipe bends in two or more planes which cause a perfect spiralling effect of the fluid passing through them while other conditions set up eddies, which without vanes, cause very poor metering conditions.

From the above discussions it is seen that to obtain correct orifice meter measurement the flow must be streamline and in order to accomplish this a vane must be so located that it is far enough away from a disturbing element so that it will not have to withstand the whole force of the disturbance. In other words, a straightening vane must be placed a reasonable distance away from a disturbing element so that it can partially hold back and evenly distribute the fluid through all vane passages.

Although it is generally conceded that straightening vanes are valueless in case of pulsation, there have been a few known cases where they have apparently been very helpful. Whether the error was due to pulsation only or to other flow conditions in one particular instance where an error in reading of 7 to 11 per cent was reduced to within 1 per

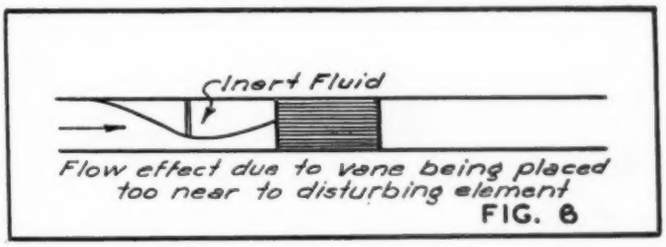

FIG. 6

cent error by the installation of a vane, is a question. It was thought in this case that it was only pulsation and, with the line heavily loaded, it is possible that the vane did help some.

Straightening vanes are not usually designed to give an

appreciable pressure drop over them, but the fact is that in some cases they probably do cause a slight loss in pressure, especially if the spaces between the tubes are partially filled by welding material. Even though the combined area of the tubes and the space between the tubes is equal to the cross-sectional area of the line, the carrying capacity of the vane is not as great as an equivalent length of pipe and would therefore probably cause a noticeable pressure drop when the line was working under full capacity. This loss is probably due to slight entrance losses on the upstream end of the vane, especially where the flow is not moving parallel to the axis of the pipe. Enlargement losses on the downstream side of the vanes are probably negligible. Increased surface friction per unit length of the vane compared to the pipe would also tend to cause a loss in pressure. However, it is doubtful whether the total of all these losses in most cases is even noticeable, except, of course, under comparatively high flow rates.

The value of vanes in liquid measurement is probably not quite as great as it is in gas lines, due to the incompressibility of the liquid which transfers pulsations and impacts, with approximately the velocity of sound. Vanes, however, are undoubtedly quite valuable in liquid flow for remedying swirling, eddies, etc.

It is also very essential in correct metering that the straightening vane should never be placed too near to the upstream tap connection, for by so doing it is possible to obtain an inaccurate calculated flow, where without the vane an accurate reading would have actually been possible.

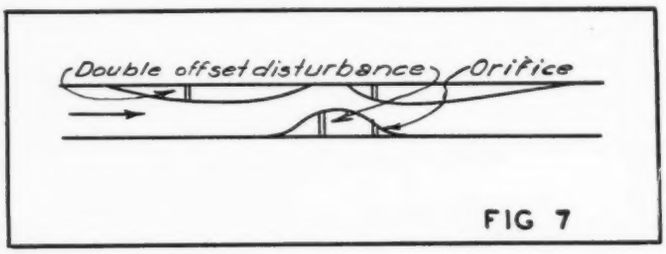


FIG 7

The nearer the vane approaches the orifice, the more the error becomes. The error formed upon bringing the vane closer to the orifice causes the volumes of gas so computed by the pressures and differentials recorded to be higher than they actually are. The reason for this might be explained from the probable fluid action under these relative conditions as shown in Figures 8 and 9.

When straightening vanes are used it is seen that the velocity of the fluid just below the vane is fairly uniform throughout the pipe and this naturally makes ($P_1PT$) greater than ($P_1^1$—PT). The greatest difference, however, is in the probable greater contraction of the jet when the vane is used compared to the jet contraction under normal streamline flow, which in the case of the straightening vane placed too close to an orifice would be using a coefficient based on a larger flow area at the point of contraction than was actually occurring in the line at the differential indicated for normal flow.

Following are a few types of vanes which have been built and are now in use by various companies. It has only been in the last year or two that gas and oil companies have endeavored to arrive at some standard set of vanes and even now there are numerous companies which build them haphazardly and with little thought as to the principles involved. Most vanes which have been installed have doubtless been beneficial, but in some cases they might have been valueless and possibly even harmful.

Figure 10 shows in detail a vane which in every way satisfies the recommendations of all engineers who have made tests upon vanes. It is the type which is now being used extensively by a number of major companies. The diameter of the tubes compared to line size and the overall length of the vane as regards tube diameter are well within all recommendations. Its vanes are symmetrically

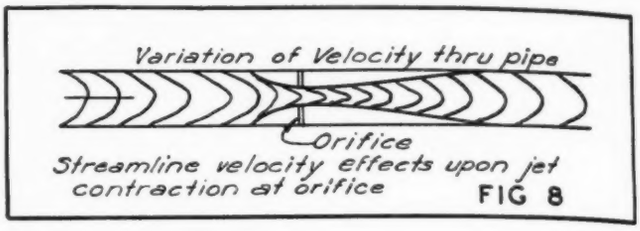


FIG 8

spaced throughout. It has the advantage over some vanes in that it can be slipped into a pipe without the need of extra fittings, which is often quite an important point. It is strongly built and can be securely fastened to the pipe by means of set screws, preventing the possibility of the vane creeping along the line. All in all, it is very satisfactory and does straighten out the flow very well. It is easily and cheaply built from standard tubes. There might be some slight disadvantage when used in two-inch pipe, due to the thickness of the ring about the tubing, which might cause excessive pressure drop. No data are available at this time in regard to vane pressure drop.

Figures 11 (a, b, c) indicate three other types of vanes which are used extensively. They all comply with the recommendations published by the American Gas Association (shown later). Their vanes are tubular and are well spaced, and strongly constructed and give almost identical results to those of Figure 10.

Figure 11 (a) indicates a type of vane which can be inserted in one flange pipe joint and is very satisfactory in every respect when such a fitting is available at the point where it is desirable to install the vane. Of course, in new installations such a flange could be made where desired.

Figure 11 (b) and 11 (c) indicate vanes made up in the form of spools or pipe sections which form an integral part of the line. They, too, are very satisfactory when the required fittings needed for their installation are available. Figure 11 (c), of course, must be placed in an original line, the type of which is seldom used in a meter run.

Figures 12 (a, b, c) show the sectional designs of vanes commonly constructed from galvanized sheet iron welded

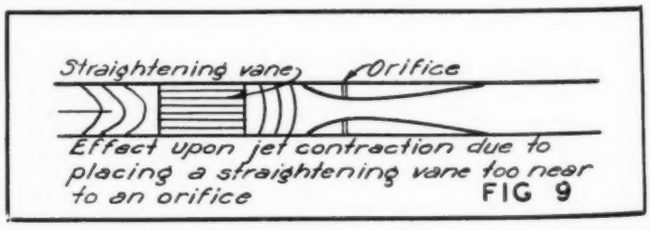


FIG 9

together. These kind of vanes are usually made up into various types of vane passages such as the star shaped in Figure 12 (a), which is only slightly different from Figure 12 (b), which utilizes a small tube at the center. Figure No. 12 (c) shows still another honeycombed vane design. These vanes can, of course, be held in the line by screws,

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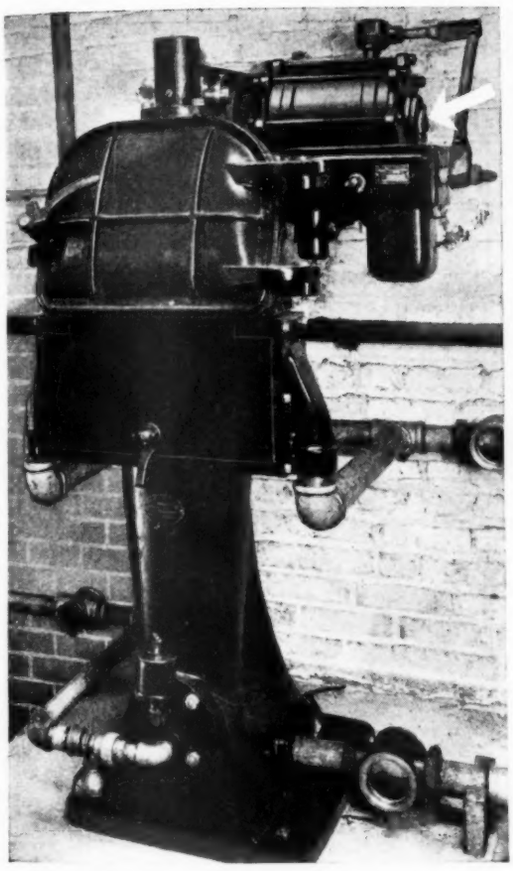

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LOUIS ALLIS

# "EXPLOSION-PROOF" *Electric* MOTORS

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held by bent-over friction ends, or actually welded into a piece of line.

An error in measurement was apparent in one case where two large 16-inch lines took off at right angles from a 20-inch header in such a manner that one 16-inch line took off up near the inlet of the 20-inch pipe and the second 16-inch line came off parallel to and directly under the other 16-inch line and slightly above the closed-off bottom of the

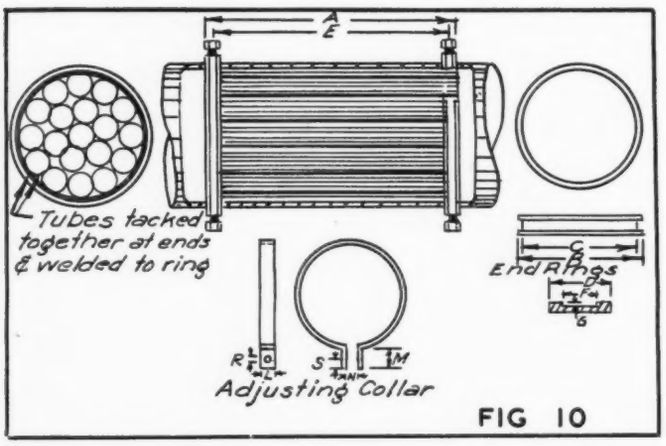
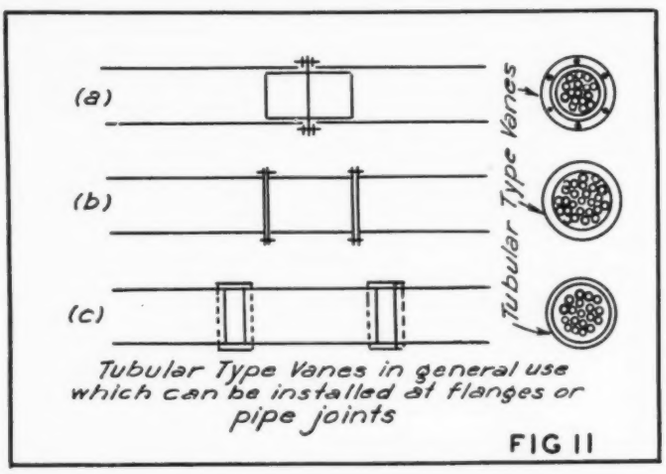



FIG 10

20-inch pipe. By checking each meter run separately and by installing vanes in each 16-inch line it was found that the lower pipe had previously read correctly, needing no vane, but in the upper pipe when the vane was installed it increased the reading some 3 per cent, which then checked all other instruments.

In another case a check was made upon a high-pressure line containing two orifices and two control valves. Each control valve was cracked the same amount. There was about 20 pipe diameters of clear pipe downstream for the first or upstream valve and the first orifice and then a short distance downstream the second control valve was placed. After this valve, however, at a distance of 5 or 6 pipe diameters downstream, a straightening vane was placed and then some 20 pipe diameters downstream from the vane the second orifice was installed. Comparative tests in this specific case showed that the downstream orifice gave volumes 4 to 5 per cent higher than the upstream orifice, even though the vane was installed too near the valve.




Tubular Type Vanes in general use which can be installed at flanges or pipe joints

FIG 11

These above tests check quite well with the test results during the year 1925-1926. These recommendations apply found by the Natural Gas Association; that is, flow disturbances nearly always cause low meter readings.

Following are preliminary recommendations based upon rather extensive tests and studies made by this committee only to circular orifices placed concentrically in a pipe and with the sharp edge of the orifice upstream.

(1) The orifice diameter should not be greater than 0.6 of the internal diameter of the meter run. If larger orifices are required, larger meter runs should be installed.

(2) Angle turns in two planes, etc., also allowable location of certain downstream disturbing elements (Figure 13).

(3) Location of disturbing elements upstream from the orifice (Figure 14).

(4) Meter runs requiring no vanes (Figure 15).

(5) Vane design.

The largest cross-sectional dimension of any vane passage should not be over 25 per cent of the internal pipe diameter.

The length of the vane should not be less than 10 times the greatest dimension of any vane passage. Vanes should be made substantial enough to withstand high flow rates without breaking up and they should be securely fastened in the line to prevent creeping.

(6) Swedges should not be placed closer than 10 pipe diameters from the upstream tap of an orifice meter run.

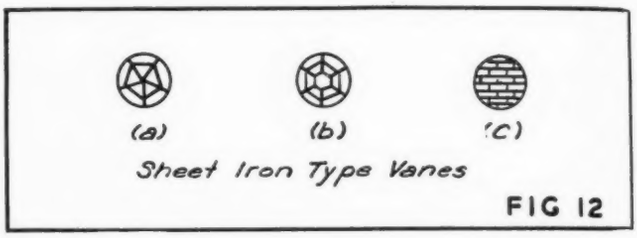



FIG 12

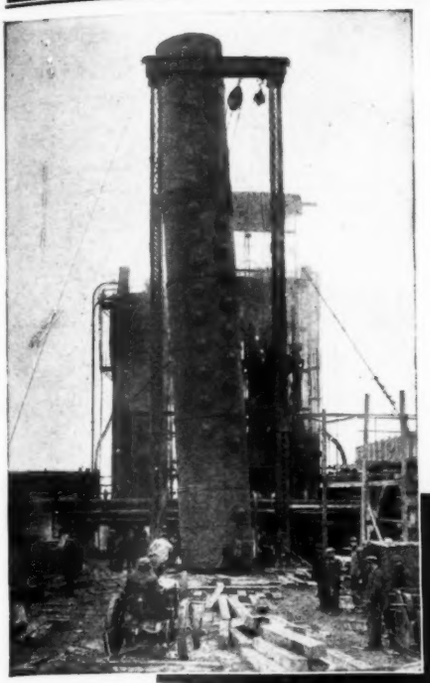
Straightening vanes will not correct for errors in metering due to swedges.

(7) Meters should be placed as far as possible from pumps, compressors, regulators, etc., which cause pulsation, for it is impossible to measure accurately the flow of a fluid under violent pulsation by an orifice meter.

(8) Swirls and Eddies. Fittings or combinations of fittings which disturb the normal flow of gas may produce swirls and eddies which generally result in abnormally low differentials and consequently generally give a lower calculated volume of gas than that actually passing through the orifice.

Vanes, when installed as recommended above, will remove these swirls and eddies before they reach the upstream orifice pressure tap.

(9) Velocity Distribution Effects. The flow of fluid under actual line conditions is never uniformly distributed over a cross-sectional area of pipe at right angles to its axis. For flows above the viscous range the velocity at the center of the pipe is usually about 20 per cent greater than the average velocity over this cross-section, while the velocity near the pipe surface is usually approximately only 50 per cent of the center velocity.



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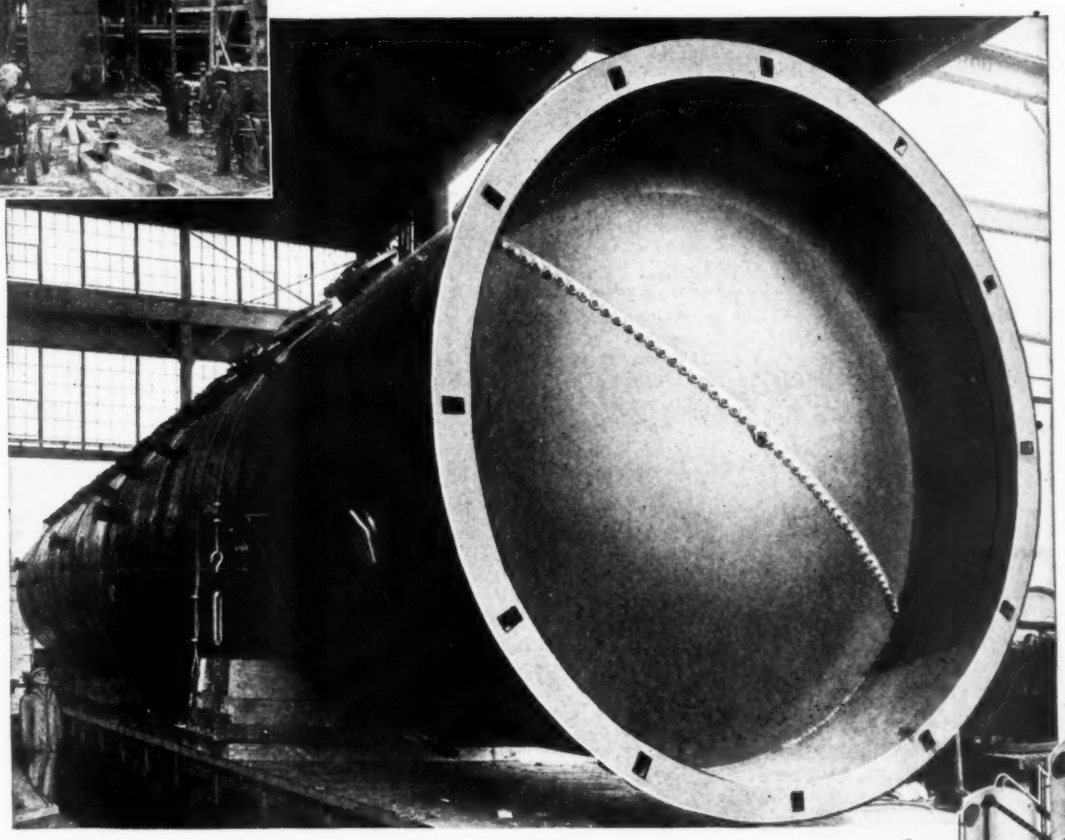

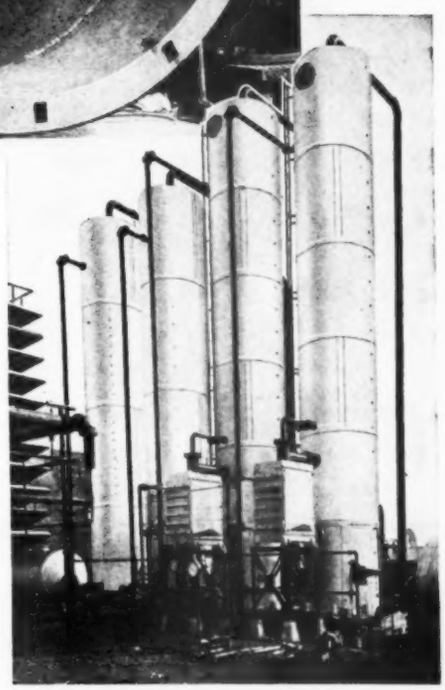

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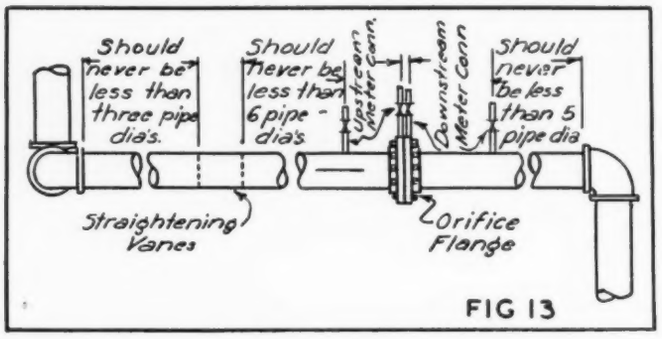
Any disturbance which tends to cause an abnormal centralization of velocity or flow at the center of the pipe will decrease the differential and therefore give negative errors in measurement. On the other hand, any disturbance which tends to flatten out the flow or velocity throughout the cross-section (see Figure 3) will give larger differentials and thus cause a positive error; that is, computed flows would be greater than they actually are.

The effect of false centralization gives somewhat the same effects as though the upstream section of the meter had been replaced by a pipe of smaller diameter, as this centralization reduces the component of the velocity of approach, which reduces jet construction.

Swedges, orifices or vanes having large central openings which are placed too close to an orifice in a line on its upstream side will cause this condition of over-centralization of flow.

Viscosity effects are only of importance in commercial measurement of gas when extremely low differentials are used. Viscosity first becomes apparent by giving lower differentials than normal, due to the fluid filling the orifice and enlarging the vena contracta out of proportion to the increased pressure registered on the upstream pressure tap,


Should never be less than three pipe dia's.
Should never be less than 6 pipe dia's
Upstream Meter Conn.
Downstream Meter Conn
Should never be less than 5 pipe dia
Straightening Vanes
Orifice Flange
FIG 13

thus giving larger volumes than are actually passing through the orifice.

For increasing non-fluidity of the gas a greater differential pressure becomes necessary to force the fluid through the orifice, consequently giving computed flows which are greater than usual.

In general, when the following equation or formula is satisfied, viscosity does not enter into the computation of flow. This formula is based on air, but holds approximately true for most gases.

$d^2\ p\ h$ greater than 10
where

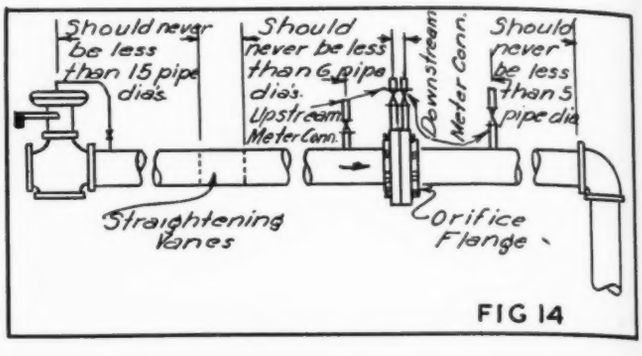
d = orifice diameter in inches.

p = absolute static pressure in lbs. sq. in.

h = differential in inches of water.

As the measurement of gas is in general merely another form of accounting, and as the value of gas or other fluid being metered is often of great value when figured on the basis of fluid value passing through a given meter run per year, it seems that the added expense required to install a nearly perfect meter run becomes negligible. The percentage allowable error in orifice measurement is gradually working toward a goal of 1 or 2 per cent.

The increased accuracy possible by the use of straightening vanes makes their small initial cost a negligible factor compared to other costs involved in building correctly-designed meter runs. Vanes often make it possible to install a correct meter run where it would not have been pos-

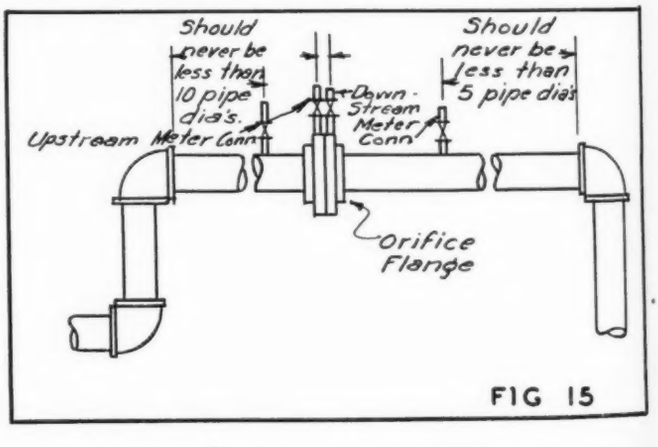

Should never be less than 15 pipe dia's.
Should never be less than 6 pipe dia's.
Upstream Meter Conn.
Downstream Meter Conn.
Should never be less than 5 pipe dia
Straightening Vanes
Orifice Flange
FIG 14

sible otherwise without great cost, due to lack of space available about a plant.

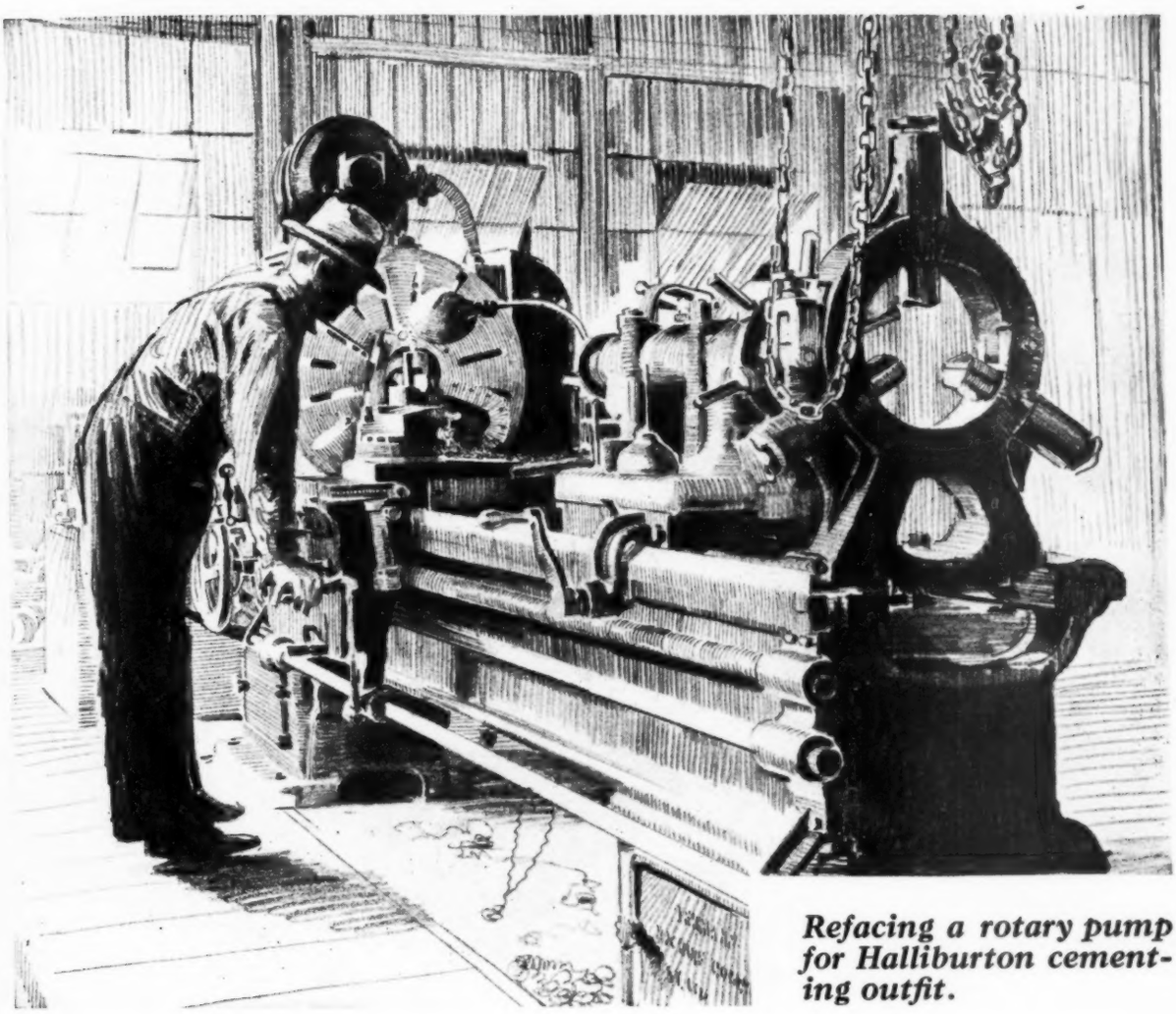
It seems that, excepting, of course, pulsations, etc., wherever there is doubt as to the accuracy of the measurement which will be obtained or is being obtained, that the installation of a vane is advisable if it can be placed in a proper location.

It is apparent that it is much more satisfactory as well as economical to install a vane in its proper position when a meter run is first being built than it is after the line is once made up. This above still further indicates that vanes should be placed at almost all important new orifice meter runs.

In closing, it might be well to state that it must not be assumed that straightening vanes are a cure-all for all metering irregularities, for in general each individual difficulty encountered in metering is often due to a combination of reasons which often require special study and sometimes experimentation.


Should never be less than 10 pipe dia's.
Should never be less than 5 pipe dia's
Down-Stream Meter Conn
Upstream Meter Conn
Orifice Flange
FIG 15

However, in general it might be assumed that if meter runs and vanes are installed as recommended by the Natural Gas Association, far greater accuracy in metering is possible and these recommended directions should therefore be followed as closely as possible until further data are available.



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Everyone associated with oil production is familiar with the big red Halliburton trucks—the "inaccessible" places Halliburton men have reached, the "impossible" jobs they have done, the dispatch that characterizes their work.

Only a comparative few, however, realize the intensive and expensive activity that goes on "behind the scenes" in the Halliburton organization—the research that is constantly undertaken to provide the industry with the highest form of cementing protection; the care that is exercised to keep Halliburton equipment in the best possible condition.

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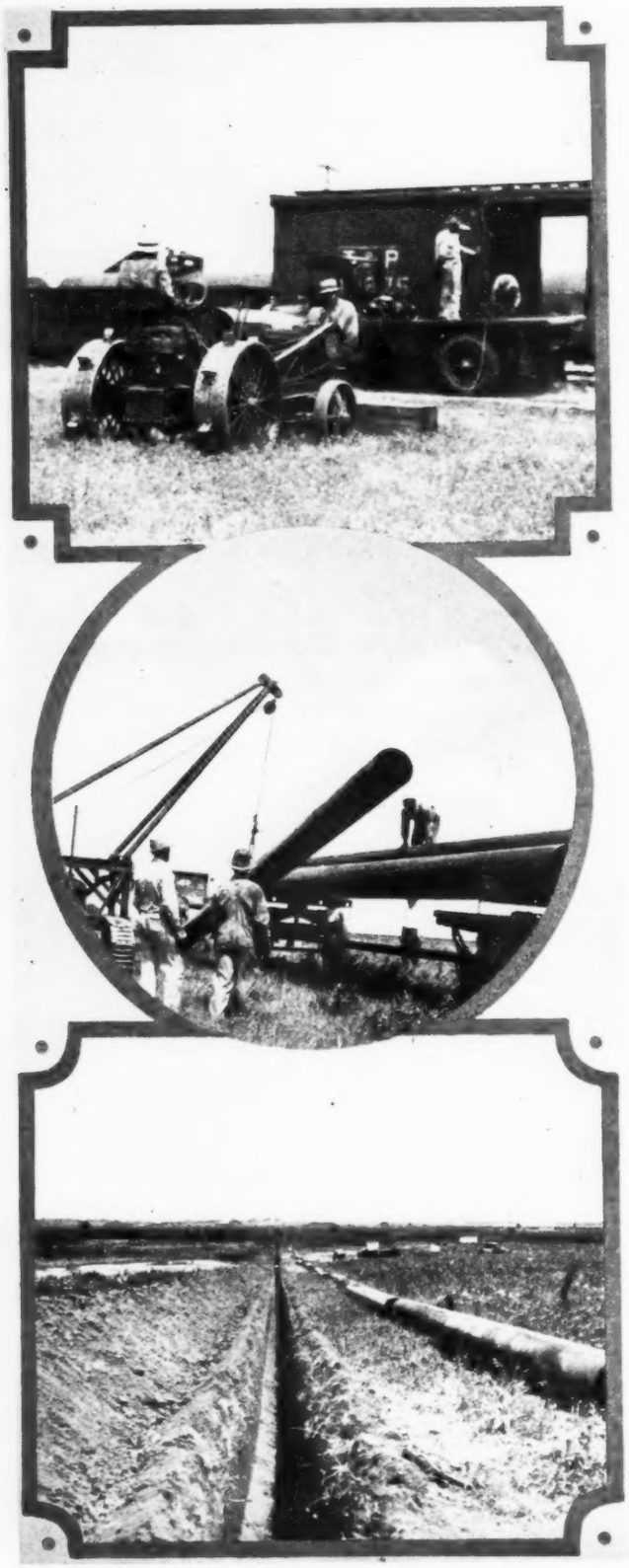
*Utilization of*

# Soil Analysis *in* Pipe Line Protection



ONE of the engineering features connected with the construction of the Ozark Gas Co.'s gas line from the Quinton, Okla., field to connect with the Oklahoma Natural Gas Corp.'s main line system, is the method of protecting the line from corrosion.

When right-of-way crews were in the field, samples of the soil were taken and analyzed. Later, these data were briefed and lettered on a large scale map in one mile intervals. Prints of the map were distributed among key men on the job.

Later flag-markers were set at every mile testing point, and these markers indicated the type of soil at that point and the thickness of a coating necessary to adequately protect the pipe. Different applications of coating were required for the varying soil conditions. If, for example, one mile was in soil where analysis indicated a minimum of trouble might be expected from soil corrosion, a suitable amount of coating material would be applied.

All of the coating is enamel applied hot in the field. Where soil conditions are considered exceptionally good only $\frac{1}{32}$ of an inch of enamel is applied. The average coatings will be about $\frac{1}{16}$ of an inch in thickness and in some cases a double coat of enamel will be applied.

Instead of ordering pipe with a lacquer or oil coating applied at the mill, the builders specified the priming coat should be applied at the mill.

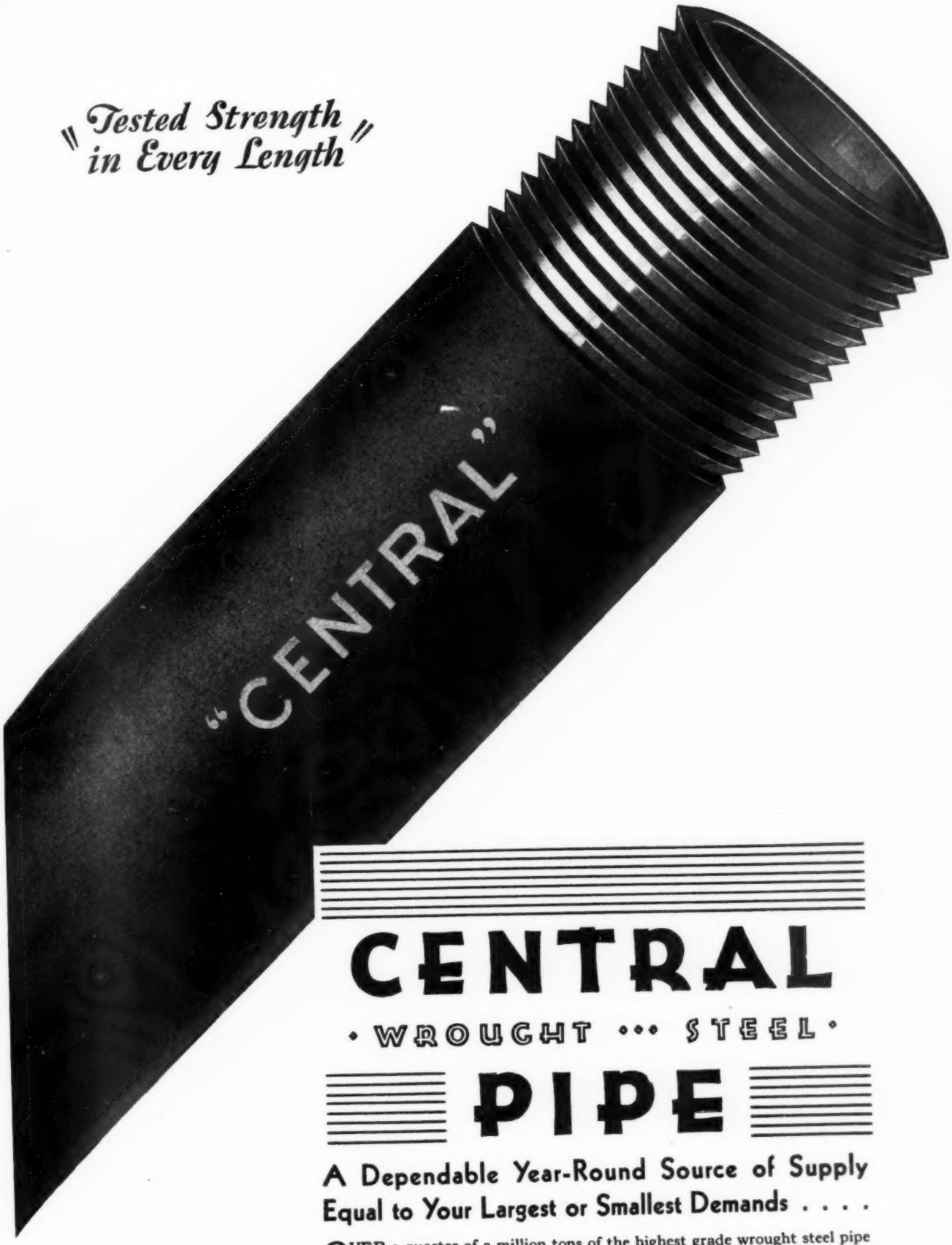
Sixteen, 12, 10 and 8-inch plain end pipe is going into the approximately 80-mile construction job which is scheduled for completion in the early fall. The pipe averages 40 feet per joint and will be joined with couplings. All of the construction equipment is modern. The line is being built by the Natural Gas Engineering Co., a recently organized engineering and consulting firm fostered by the Oklahoma Natural Corp.

The line leaves the Quinton field with five miles of 10-inch which ties into five miles of 12-inch going to Kinta. Approximately 30 miles of 16-inch is in the section going north from Kinta to Whitefield, angles to the west and thence north to Warner junction. From that point 11 miles of 8-inch runs north to connect with the main line running to Muskogee. From Warner the 16-inch goes northwest to Bald Hill, a distance of 33 miles, to intersect the company's main line. Thus the line tapping a 7,000 acre gas reserve, connects with the Oklahoma Natural main system in two places.

The 16-inch line will have a capacity of 40,000,000 feet of gas daily. Field pressure will be utilized until it falls to a point below the desired operating pressure.

**Top—Unloading equipment at Quinton with a tractor. Center—Stringing pipe on the right-of-way. Bottom—Ready for coupling.**

*"Tested Strength in Every Length"*

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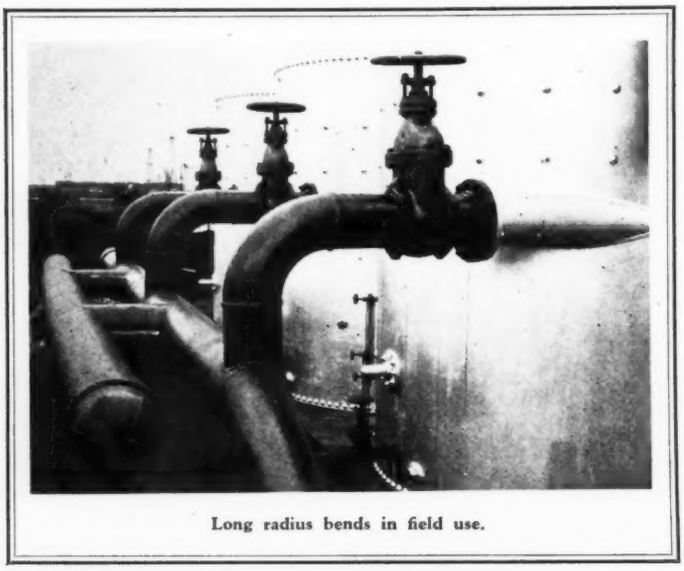
# Long Radius Bends Have Many



Long radius bends in field use.

IT is not so very long ago that had one mentioned the word efficiency in the oil industry, particularly in the pipe line branch, one would have occasioned a laugh. However, in commercial life, no matter in which direction, competition is becoming keener every day, with the result that the organization which can produce an equally good article at a lower figure than its competitors is the one that is likely to survive. As in the oil industry, so in engineering, it is a difficult problem for marketers of such products today to sell any type of mechanical equipment that has not been proven to be of high efficiency or if not already proven to be such that the manufacturers are willing to guarantee them to be highly efficient. "Friction" is the bugbear of the engineer and, wherever it can be eliminated or reduced, cost of production will just be that much less.

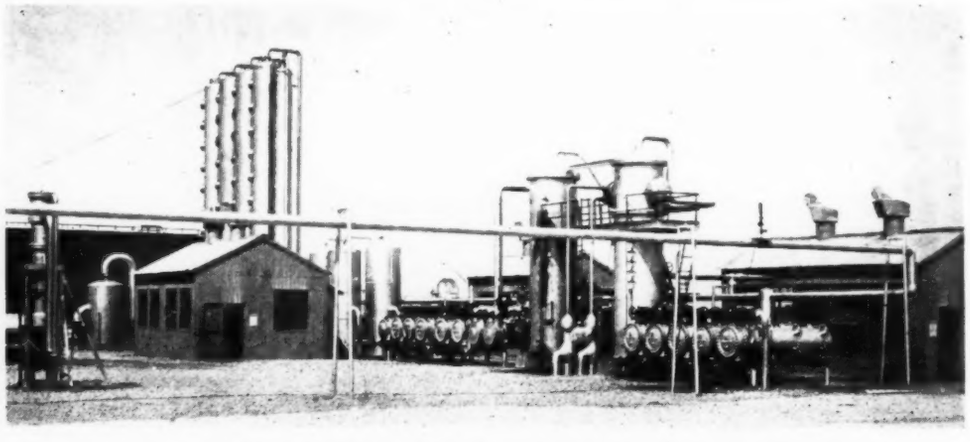
In pipe fitting, the longer the radius of the bend used and the smoother the interior of the bend, the less will be the friction, and the adoption of long radius bends* has proved so successful in the field, in the refinery and in the pipe line department that their use is becoming almost universal. Not only does this fitting lessen friction losses, but, as shown in the accompanying photographs, it adds greatly to the appearance of any installation on which it may be used.

*First made in Germany about four years ago and introduced into this country two years ago.

The accompanying illustrations show several uses of radius bends in the petroleum industry. Their use in gas measuring stations, on field tankage, in natural gasoline plants and compressor plants are illustrated.

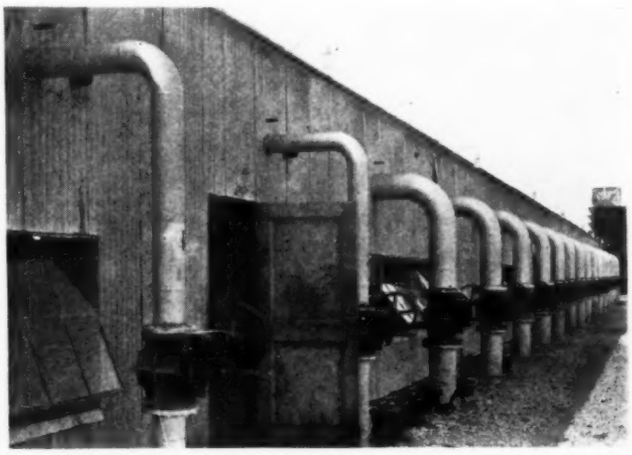
In substantiation of the statement that friction is reduced, a test might be quoted. A measured quantity of water was allowed to flow from one point to another at the same head in each case. With the use of a 90-degree weld the water took fourteen minutes to pass. When a fitting was used the water took seven minutes to pass, and with the long radius bends the same quantity of water, again at the same head, took only six minutes to pass. One reason for the gain in efficiency is that, due to the method of manufacture, friction losses at entrance and exit of the long radius bend are reduced to a minimum. The radius of the bend is equal to one and half times the diameter of the pipe, which radius is considerably greater than that used on the standard fittings heretofore almost universally adopted.

In helium gas plants throughout the country tests have shown that where fittings absolutely failed, welded long radius bends were good for, and showed no loss by leakage or breakdown up to, a pressure of 2100 pounds per square



A natural gasoline plant where radius bends are freely used.

# Uses *in the* Petroleum Industry



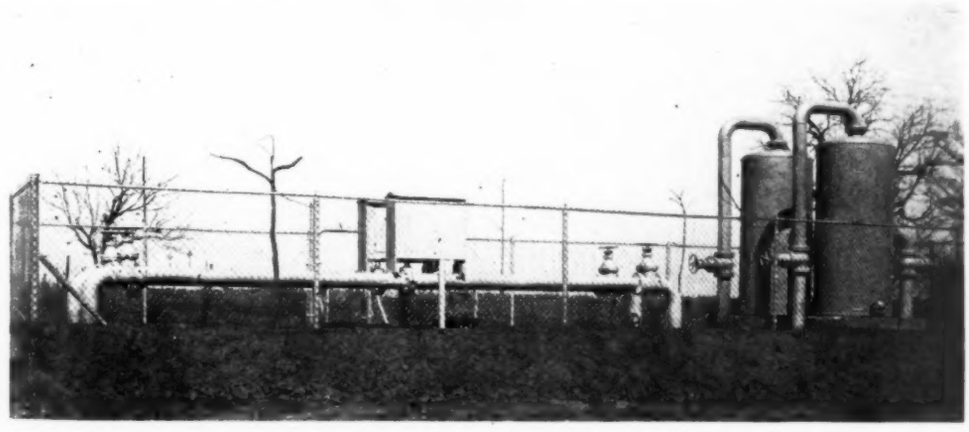
Radius bends in a compressor plant.

inch. Because of the way in which the fittings being discussed are made, the inside wall is almost perfectly smooth and mention need hardly be made that such a condition must give rise to increased efficiency. Further, it might be supposed that a tube being expanded over a mandril, the outer radius would be stretched, leaving the metal weak, but such is not the case. The structure of the tube actually becomes more dense and consequently gives it more resistance in counteracting the cutting action of the liquid or the gas flowing through it.

The long radius bend is adaptable for any type of plant work and is easily fitted. It is so constructed that it can be cut by means of a torch and readily made to meet different conditions as they arise. A glance at the photographs will show this point. The ends of the long radius bends as they come from the factory are beveled, ready for welding. It can be readily seen that when pumping gas or crude oil, or other inflammable matter, the adoption of the long radius bend will help to eliminate fire hazards, and also, where hot oils are being pumped, the danger of leaks which may result in serious burns would be eliminated. Doubtless the welded fittings used extensively in the past few years are as safe from the point of view of leakage as the long radius bend, but the loss due to friction in the former is more than twice what it is when the latter is used. Consequently, for the prevention of fire, either the 90-degree weld or the radius bend is best; but as the friction loss is so much higher in the 90-degree weld than in the modern product it would be reasonably supposed that the latter should receive first consideration.

In the pipe line branch of the industry much good work has been done to eliminate shock in the line, and it is believed that introduction of long radius bends throughout the station system would help materially in this direction. Although it has no direct bearing on the subject under discussion, a point might be brought up with reference to station work on pipe line service that would illustrate the present trend to endeavor to get better efficiency in the industry. It might be stated in passing that it is interesting to note this struggle that appears to be going on in the pump industry at the present moment between manufacturers not only of the different types of pumps, but manufacturers of similar pumps, in trying to obtain as high an efficiency as possible. With power companies coming into line with favorable rates, it seems to the writer, as a casual observer, that drastic changes in the transportation of oil may be seen in the very near future.

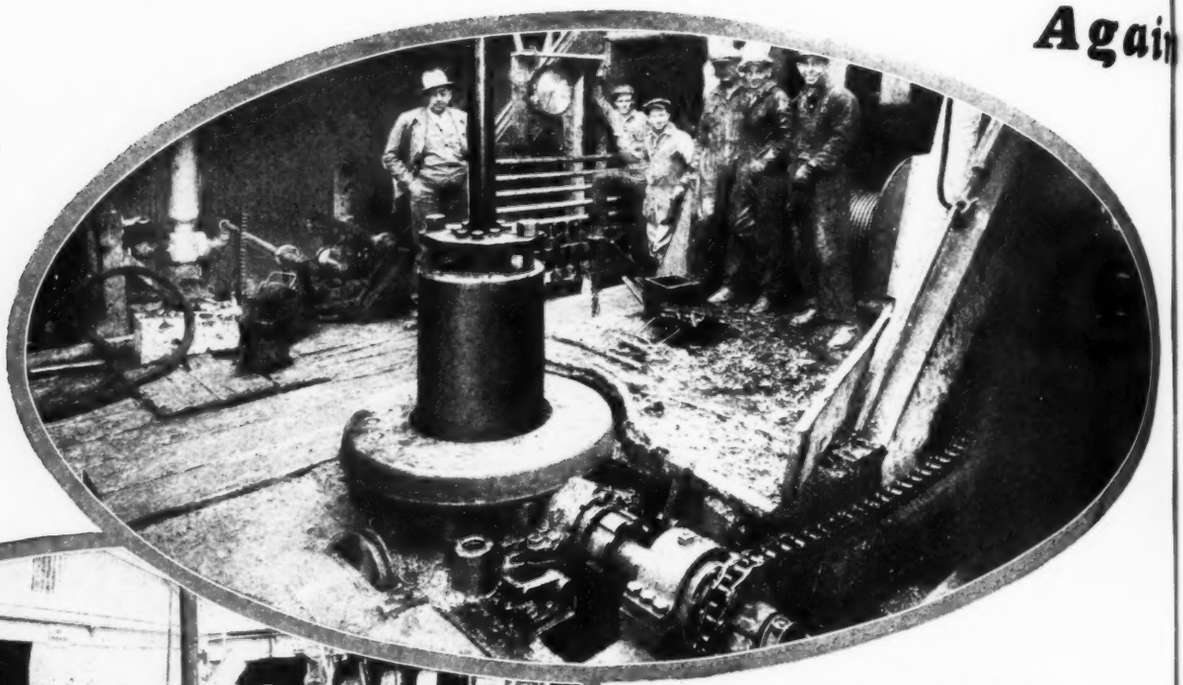
In order to emphasize the point of safety, it might be reiterated that when handling any inflammable material no company can afford to ignore a fitting such as the long radius bends, which not only gives much higher efficiency, but does so much in the elimination of danger.

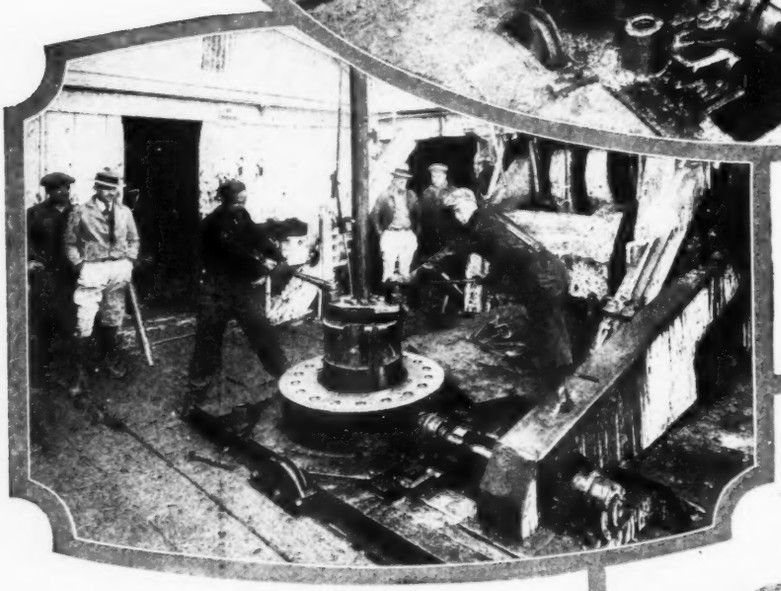


Gas-measuring station using bends.

# Sheldon-Burden

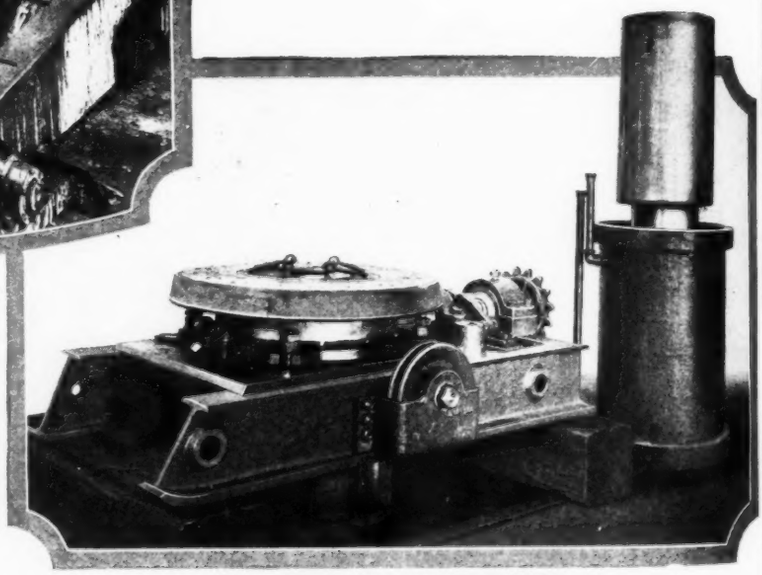
**Agai**





*Mills City, Well No. 1, Turner Valley, Calgary, Canada. Drilling against rock pressure of 1,500 pounds with oil circulation at the depth of 4,700 feet.*

*Mills City, Well No. 2, Turner Valley, Calgary, Canada. Drilling depth, 5,284 feet. Circulating with oil, carrying pressure controls for handling three thousand-pound rock pressure.*



*Type HR Hydraulic Feed Table*

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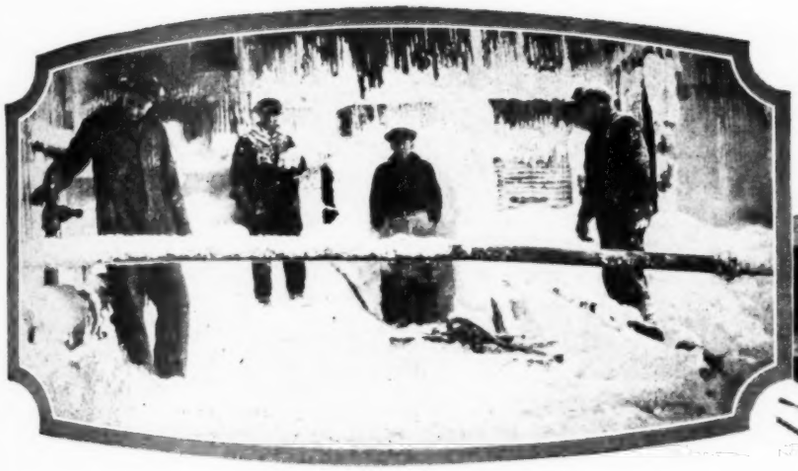
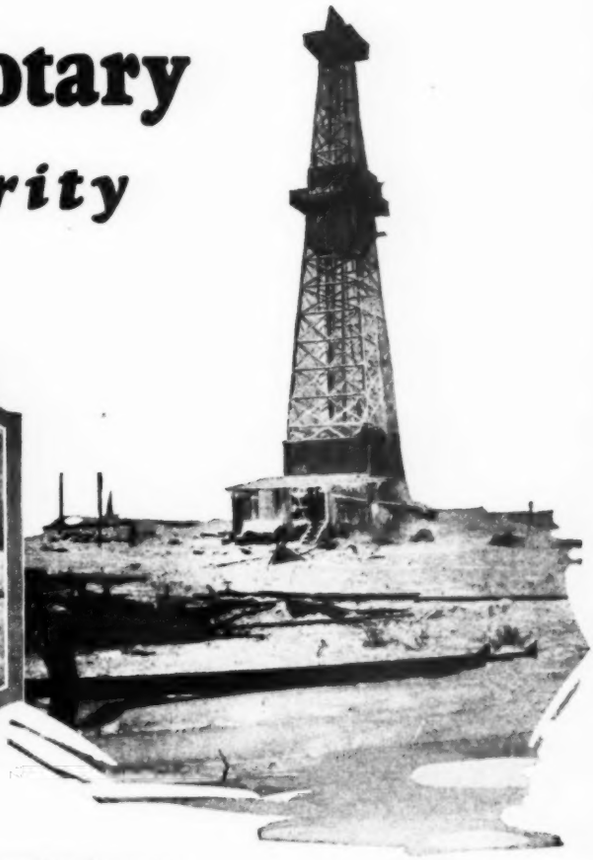




**TURNER VALLEY presents some difficult problems for the operator to overcome—such as: hard abrasive formations with steep dips and high gas pressures, deep wells and extreme cold in winter.**

**That Sheldon-Burden Hydraulic Feed Rotary Tables have proven their superiority under these severe conditions is testified to by the various users of the equipment.**

**One oil company who uses it says: "The Hydraulic Feed is as far superior to the — — — Feed as the — — — Feed is over the ordinary Rotary."**

**A consulting geologist who has been watching the performance of Sheldon Equipment says: "The Sheldon-Burden Hydraulic Rotary is the ideal system for drilling in wells in Turner Valley."**

**A well-known and successful drilling contractor who owns and uses this equipment says: "You have convinced us absolutely of the Hydraulic idea for Rotary Drilling."**

**Another equally as well known and successful drilling contractor who bought a Sheldon-Burden Hydraulic Feed Rotary Table to try it out is evidently convinced as to its superiority, for he states: "Everyone of our rigs in Turner Valley will be equipped with the Hydraulic Feed in the future."**

**Another oil company who owns and uses Sheldon Equipment states: "Thoroughly satisfied with the operation of Sheldon-Burden Hydraulic so far."**

**Earned praise of the above kind should convince any progressive operator that Sheldon Equipment is definitely superior to ordinary equipment. If you haven't investigated its various merits, why not do so now? Start in by writing us for descriptive matter.**

## SHELDON MACHINERY CORPORATION

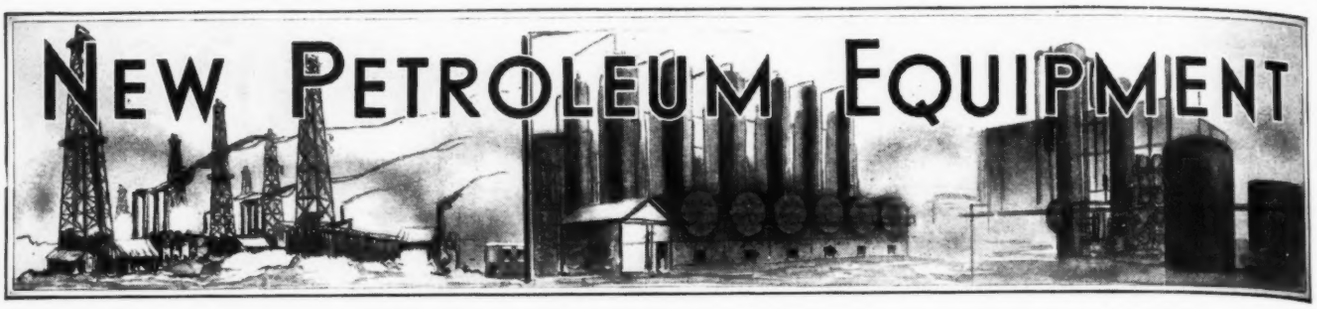
**15 Park Row, New York**

**Branch Office: 718 Second National Bank Building, Houston, Texas**
**Distributors: Oil Well Supply Company, Lucey Products Corporation**

# -BURDEN

# ROTARY TABLES

*When writing* SHELDON MACHINERY CORP. *please mention The Petroleum Engineer*




## American Arch Company Moves Headquarters

THE American Arch Company, manufacturers of air-cooled walls and suspended arches for boiler furnaces and industrial furnaces, has moved its main offices from 17 East 42nd St., to the Lincoln Bldg., 60 East 42nd St., New York City.

## The Hill and Foster Tong

THE Hill and Foster Company of Wichita Falls, Texas, is offering for sale a new combination pipe and tool joint tong.

It is claimed that the tong will catch and hold any size pipe from 6½-inch O. D. to 9-inch O. D. without the use of bushing; it will catch and hold any size pipe from 4½-inch O. D. to 6½-inch O. D. by the addition of one flexible bushing that can be installed. It has an optional automatic latch, that is, it can be used without a latch where only a single pull is required and the maximum speed desired, or it can be used with an automatic latch by a quarter turn of the hand wheel. It has a roller bearing in the handle.

## Signode Aids in Insulating Oil Tanks, etc.

IT is interesting to note that along with the general adoption of insulants for oil tanks, heating pipes, etc., that in Germany the insulation is being applied directly to the tanks and the Signode Steel Straps hold it in a permanent position. In insulating all kinds of large piping connections, etc., both indoor and out, Signode Strapping is coming into wider use. It is said to have complete flexibility and ease and speed of application.

## Fluor Corporation Progresses on Construction

THE Fluor Corporation, Los Angeles, Calif., reports that good progress is being made on two large jobs now in process of construction in Southern California, for the Union Oil Company and the Barnsdall Oil Company. The Union Oil Company contract calls for the installation of twelve 200-horse-power direct connected gas engine-compressors at their Santa Fe Springs Plant. The Barnsdall contract is for the installation of ten 170-horse-power gas engine-compressors at Elwood, Calif.

The Barnsdall specifications also call for a complete evaporator plant which is somewhat unique in oil country installations. It is the intention of the Barnsdall Company to evaporate sea water in this plant, in order to obtain the required fresh water for plant make-up.

## Ginter Chemical Laboratory

THE Ginter Chemical Laboratory has been organized for the purpose of making available to the oil industry a specialized laboratory service. Work will be done under the direct supervision of R. L. Ginter, for ten years general manager of the Tulsa Laboratories, Inc.

Producers and refiners of crude oils are offered a laboratory service which covers modern testing method and their application to practical and research problems.

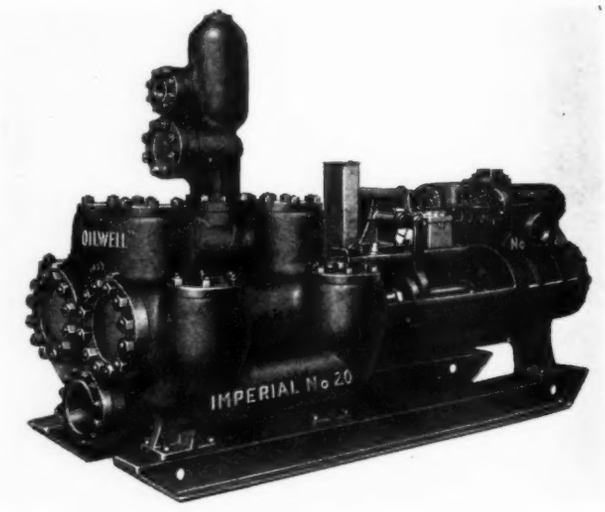
Offices have been opened at 118 West Cameron, Tulsa, Oklahoma.

## New Oil Well Imperial No. 20 Slush Pump

AUTOMATIC lubrication, a new type liner spacer, and direct fluid flow are three of the several features of the New Imperial No. 20 Steam Slush Pump, built by the Oil Well Supply Co., Oil City, Pa.

In the new Imperial No. 20 (15-in. x 7¾-in. x 20-in.) slush pump a new type liner space is said to eliminate all bolt adjustments through the cylinder head. This liner spacer also permits the water piston to be removed without disturbing the liner, and eliminates the necessity of packing and adjusting set screws each time the piston on the fluid head is removed for any purpose.

A special automatic lubrication to all working parts takes care of the oiling. The fluid end is tested to 3,000 pounds



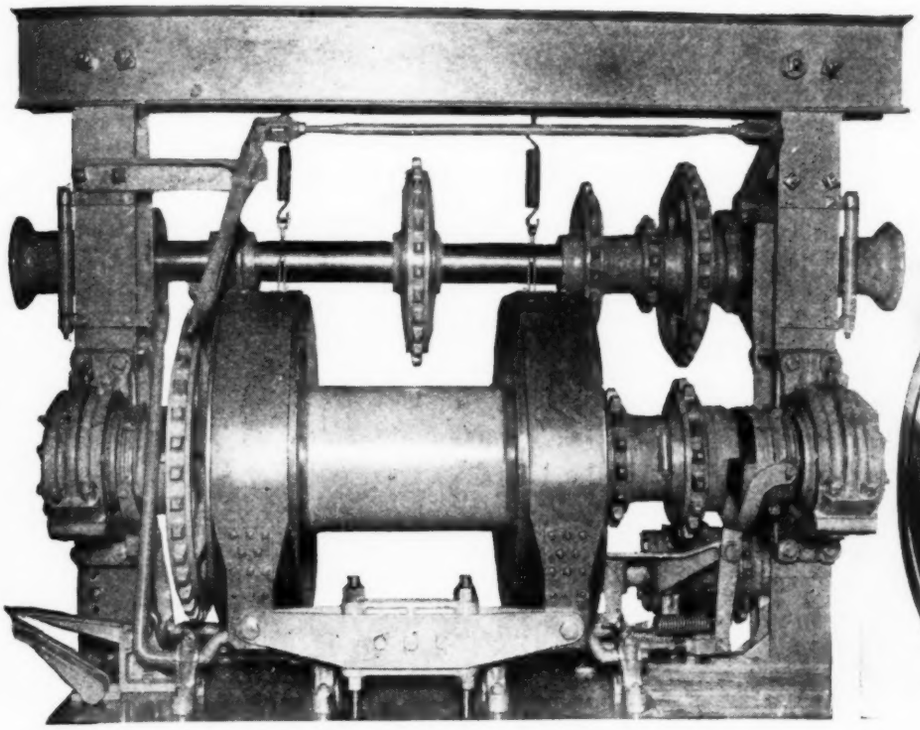

at the factory, and incorporates the principle of direct flow in which the friction and travel of the fluid is passing through the large, unrestricted passages of the fluid end are reduced to a minimum.

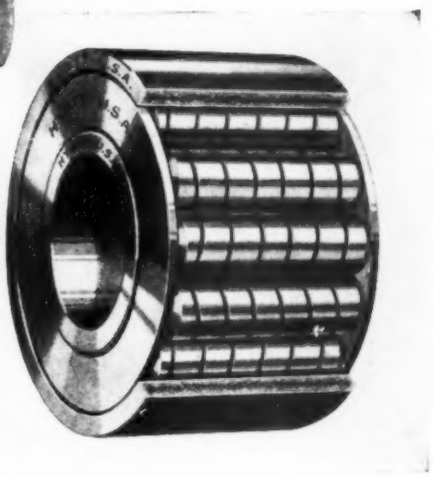
The steam end is designed for 350 pounds pressure and contains balanced steam piston valves, which reduce valve drag or friction; steam inlet on top; permitting connection from any direction; and steam exhaust connections on either side.

In drilling and pumping units, the ability of Hyatt Roller Bearings to deliver smooth, uninterrupted performance under the stress of heavy loads and steady demands has placed Hyatt in an enviable position of preference.

For, with free-running Hyatts, friction, wear and lubrication are minimized . . . shut downs for bearing repair are eliminated, adjustments are unnecessary, and speedier production is made possible.

# Draw Works . . . Hyatt protected, by Titusville





No. 8, Two Post all Hyatt Roller Bearing Draw Works, built by the Titusville Iron Works Co., Titusville, Pa.

In draw works . . . as in blocks, rotaries, pumps, pumping units, and other important field equipment . . . Hyatts provide lasting bearing satisfaction, and permanent operating economy.

The Titusville Iron Works Co., like most other builders of high grade oil well machinery, find Hyatts a profitable investment and a constant protection for the user.

HYATT ROLLER BEARING COMPANY

Newark Detroit Chicago Pittsburgh Oakland

HYATT

ROLLER BEARINGS

PRODUCT OF GENERAL MOTORS

*When writing* Hyatt Roller Bearing Co. *please mention The Petroleum Engineer*

## Syfo Clinograph

THE principal characteristic of the Syfo Clinograph, for measuring deviations in holes, is the use of the symphonic action for transferring the recording fluid from the delivery to the recording and from the recording to the receiving chamber, while making an inclination record.

The operation of the Syfo is simple, according to the manufacturers, the results obtained are accurate and read directly without computations. The records are made on paper, which can easily be filed for reference purposes.

The time required for making a test with Syfo is very short. Drilling is suspended only during the make of the test, as it will run inside of a four-inch drill stem and tool joints. It is either let down on a wire line or can be dropped into the hole by the "go-devil" method prior to pulling out the drill stem.

The performance of the Syfo is as follows: After inserting the recording paper furnished with the Syfo in the recording chamber and after selecting the proper size orifice (according to the depth at which the inclination is to be recorded), the orifice chamber is filled with the recording liquid, which slowly discharges through the orifice into the delivery chamber, filling it gradually until the upper bend of the syphon is reached. At this moment the liquid immediately overflows into the recording chamber, gradually rising until the upper bend of syphon is reached, when again the liquid overflows through syphon into the receiving chamber. While passing through the recording chamber the liquid leaves an impression in color on the recording paper, showing exactly the relation of the surface of the liquid to the vertical axis of the brass column at the depth at which the test is made.

---

## New Spencer Tandem Axle Pole Trailer

THE Spencer Trailer Co., Augusta, Kansas, has announced the new Spencer Tandem Axle Trailer for extra heavy duty. The outstanding features are the independent act of each wheel of the other three over rough ground. Even when drawn at a 45-degree angle across a ditch the trailer maintains its equilibrium without dangerous sagging and swaying. A ten-ton Spencer Tandem Axle Trailer is no more wearing on a road than a five-ton Spencer Single Axle Trailer. It will permit greater overloading in proportion to rated capacity than any other model constructed by Spencer, because each end axle are indirectly loaded and are not subject to the same proportionate strain as in single axle jobs.

The Spencer trailers are distributed by Leland Equipment Company, Tulsa, Okla.

## Peco Oil Well Stuffing Box and Rubbers

THE Producing Equipment Company (James R. Cole), Tulsa, Okla., has just placed on the market a new type of stuffing box which uses any standard size of the Oil Saver Type of Rubber. The Peco rubber, for which the box is designed, has 32 small oil holes running practically the entire length of the rubber.

The stuffing box is a convenient design, as in opening it the nuts and bolts are not removed but merely thrown back, permitting the top to be lifted, which fully exposes the entire packing chamber for repacking. No gasket is used. The box has an extra large oil or grease reservoir, which is reinforced to withstand the jar of the polished rod clamps.

---

## New Laboratory Tests Pumping Equipment

THE Petroleum Equipment Company of Texas, Inc., located at Fort Worth, Texas, has installed a complete laboratory for the purpose of conducting the most exacting tests on metals and their application from a scientific basis in the manufacture of balls and seats.

A Rockwell hardness tester, which is recognized for its sensitiveness and precision in the testing of steels, is included in the laboratory. This instrument permits tests for securing the proper hardness of the metals without getting them too hard, resulting in broken balls and seats, or too soft, resulting in balls and seats washing.

Complete corrosion tests by acids can be made to determine the fitness of a particular metal to a corrosive application. In addition to standard laboratory equipment, special machinery has been developed which permits the ball and seat, as well as the valve, to be subjected to the same pounding conditions it meets when in the bottom of the well.

Every operation in the manufacture of balls and seats is controlled in the plant of the Petroleum Equipment Company. Electric furnaces, with automatic pyrometer control, insure uniformity. Grinding is on a precision basis, and accomplished with the latest types of equipment.

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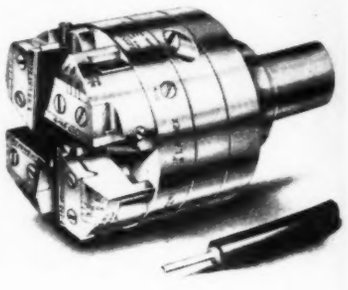
## The Internally Tripped Landex Head

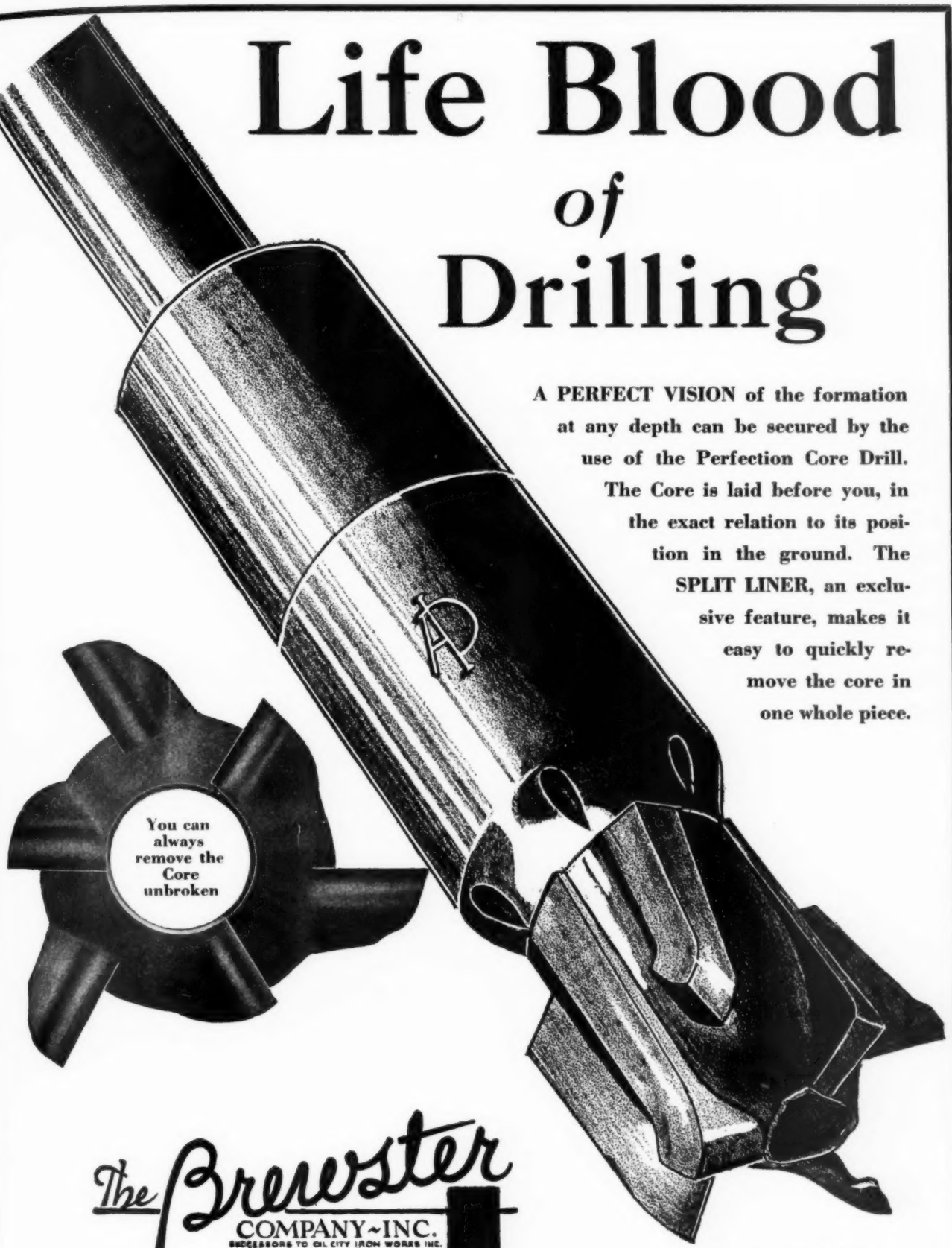
THE internally tripped Landex Head is a recent development by the Landis Machine Co., Waynesboro, Pa. The internal tripping attaching makes the Landex Head applicable for close to shoulder threading on work which varies in length and on work where a uniform length of thread is required.



The tripping mechanism consists of a plunger held in the shank of the head, the shank being drilled and tapped to accommodate it. The plunger is adjustable and can be set to any thread length within the capacity of the head. The internally tripped Landex Head, when used on automatic screw machines eliminates the necessity of accurate timing of the head opening cam, as the head is positively tripped when the end of the work comes in contact with the tripping plunger, according to the makers.

This head, when used on a machine such as a drill press, eliminates the necessity of chucking, a socket or floating fixture being used to hold the work. It is made in sizes for threading from 3/16-inch to two inches in diameter.

# Life Blood *of* Drilling




**A PERFECT VISION of the formation at any depth can be secured by the use of the Perfection Core Drill. The Core is laid before you, in the exact relation to its position in the ground. The SPLIT LINER, an exclusive feature, makes it easy to quickly remove the core in one whole piece.**

The Brewster COMPANY~INC.
SUCCESSORS TO OIL CITY IRON WORKS INC.
*Shreveport, Louisiana*

**Other Brewster Products**

Include: Chrome Nickel Drill Collars, Six Blade Rock Bits; Special Fish Tail and Gumbo Bits; A. P. I. Shouldered Tool Joints; Core Barrel Cutter Heads for both hard and soft formations—hard formation cutter heads are faced with a substance of diamond-like hardness.

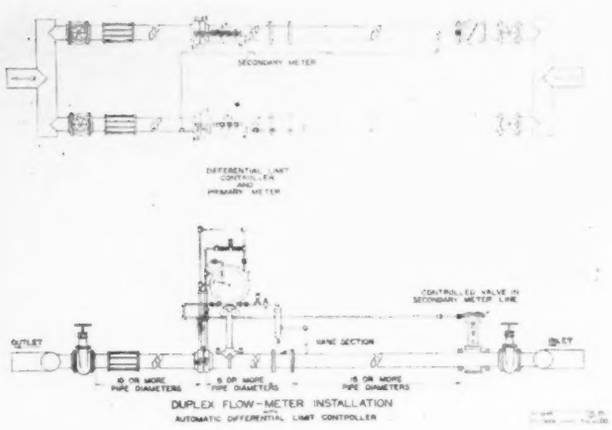
COMPLETE STOCK carried at these warehouses: Iverson Specialty Co., Oklahoma City, phone 2-2833; Houston Store, 2000 Harrington St., phone Capitol 3021. Distributors: Wilson Supply Co., Houston, Beaumont and Luling, Texas; Continental Supply Co., all stores; Murray-Brooks Hardware Co., Lake Charles, Louisiana; T. T. Word Supply Co., Houston, Texas, and Lake Charles, Louisiana; El Dorado Foundry, Machine & Supply Co., El Dorado, Arkansas.

Exclusive Export Agents: The W. K. M. Company, 74 Trinity Place, New York, N. Y.

*When writing* THE BREWSTER COMPANY, INC., *please mention The Petroleum Engineer*

## Differential Limit Recorder-Controller

THE Foxboro Company of Foxboro, Mass., has perfected a new instrument called a Differential Limit Recorder-Controller. This controller, when working with the Foxboro Gas Meter, will successfully meter flow that is varying over so wide a range that even a wide Range Meter will not allow satisfactory readings.




Once installed, the Controller continually gives a record of the gas flow through the line. It is specified to handle the minimum rate of flow with commercial accuracy. When the differential range is exceeded the control functions and automatically opens a valve which puts the secondary meter in operation. This second meter is a complete Foxboro Gas Flow Meter operating in the By-Pass. When the secondary meter goes into operation it doubles the effective capacity of the set up. When the flow again is within the capacity of the primary meter the control functions and places the entire load on the primary meter again.

## Tube-Turns Enlarge Plant

ADDITIONS to the plant itself and in equipment which increase the production of Tube-Turns, Inc., Louisville, Ky., by 60 per cent, were announced by Walter H. Girdler, president of the Girdler Corporation, which operates the Tube-Turns company, manufacturers of seamless forged, short-radius, uniform wall fittings for pipe welding.

Expansion of facilities has been made necessary by increased sales, states Mr. Girdler. The first five months of 1930 were 271 per cent more than the corresponding period of last year in sales. The plant is operating 24 hours a day, six days per week.

Markets of the company have been extended to Hawaii, Canada and Central and South America.

## Swann Chemical Company Formed

THEODORE SWANN, President of the Swann Corporation, Graybar building, New York City, has announced the formation of the Swann Chemical Company to consolidate the Federal Phosphorous Company, Federal Carbide Company, Federal Fertilizer Company, Jax Plant Food Company, Southern Manganese Corporation, Southern Manganese Mining Corp., and Southern Manganese Land Company.

## Bridgeport Opens Hugoton Store

THE Bridgeport Machine Co., of Wichita, Kansas, has established a branch store at Hugoton, western Kansas. W. E. McLaughlin, Bridgeport salesman from the Pampa, Texas, branch will look after the Hugoton business.

## Allis-Chalmers Announces Distributor

DISTRIBUTION of the Allis-Chalmers line of equipment to the oil industry in California will be handled by The Oil Well Equipment Corporation of Los Angeles, according to announcement just released. A. E. Hunt, Allis-Chalmers Sales-Engineer, formerly in the mid-continent, will assist the California organization in service and distribution. Stocks are to be carried in Los Angeles.

## Foreign Distributors for Continental Equipment Co.

THE Continental Equipment Company of Los Angeles announce the appointment as overseas distributors of Continental oil well turbine pumps and other equipment of the T. T. Word Supply Company of Houston for the following territory: Mexico, South America and Burma. Joseph Streda is to be distributor in Roumania, with headquarters in Ploesti.

## Baash Ross Announce New Appointments

H. H. CLARK, vice-president and sales manager of the Baash Ross Tool Company, has announced the appointment of E. S. Self and E. C. Adams to the sales organization.

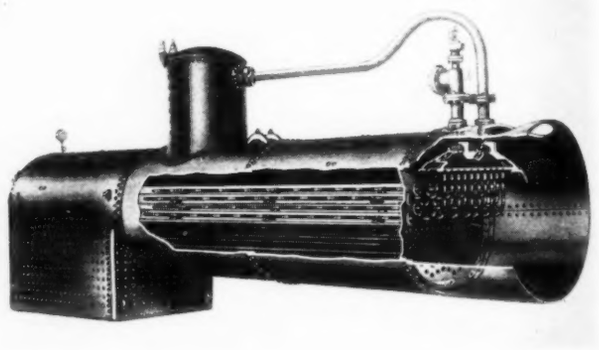
Mr. Self will devote his efforts exclusively to the sale of the Baash Ross bit and will cover all of the fields throughout the country. Mr. Adams will render a specialized engineering sales work on the Baash Ross specialties, with the engineering forces of the California oil companies.

## Key Boiler Company Expanding

THE Key Boiler Equipment Company of East St. Louis, Ill., issued a 50 per cent dividend on its stock last December, and is now completing a large addition to its plant, which will be ready for operation about the middle of August. The Key Company manufactures oil refinery and power plant equipment under its own patents.

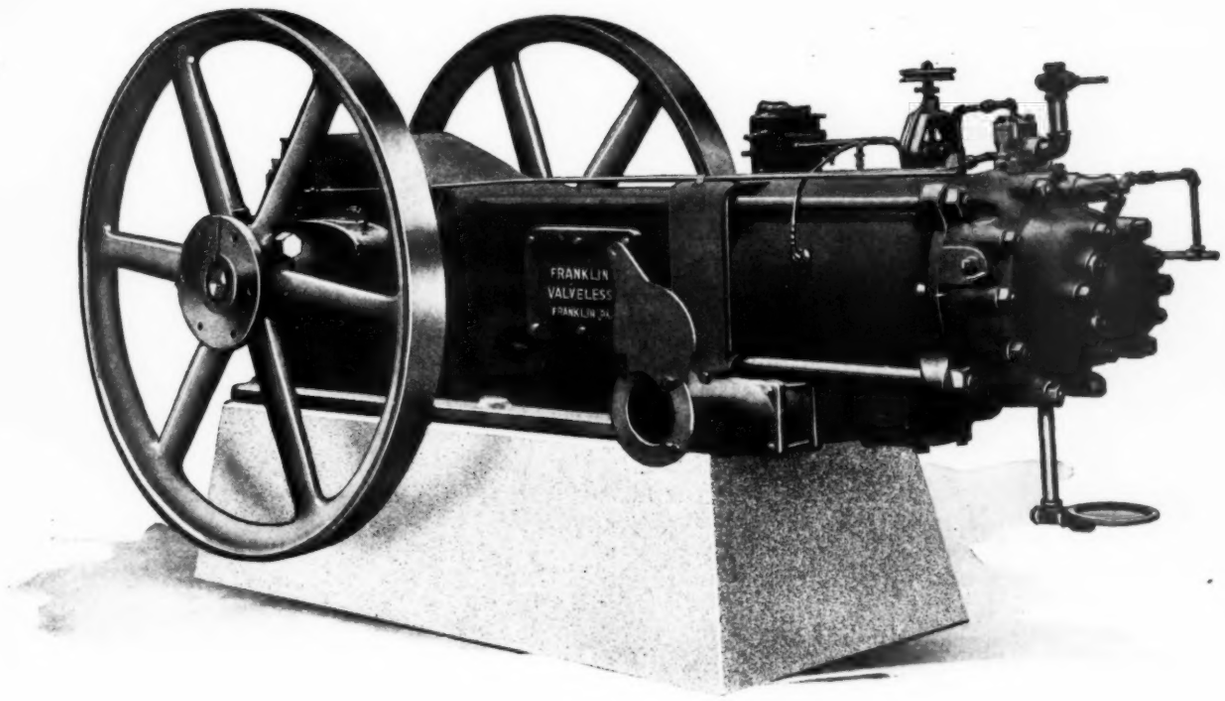
## Broderick Has New Superheater Boiler

THE Broderick Company, Muncie, Ind., has introduced a new boiler equipped with Elesco Superheaters. The company during the latter part of 1929 conducted an 18-day test of boilers equipped with superheated steam apparatus and those not so equipped. The test was conducted in the Humble Field, Humble, Texas.



The Broderick Company states that the test showed that the superheated boiler offered many advantages over the saturated steam equipment.

The details of this very interesting test and also the data on the new Broderick boiler may be obtained by writing to the company. Valuable data were secured during the test that should be of interest.




# The Franklin Valveless Oil Engine may be equipped to handle

Drilling
Pumping
Power

# Loads

Here is the finest oil engine made; positive 3-point cylinder lubrication—balance splash—interchangeable and reversible bearings and strength and simplicity assure efficiency and economy—power at all speeds. 40 - 50 - 80 H. P. Investigate through our distributor or write direct

**Franklin Valveless Engine Company**
**FRANKLIN, PENNSYLVANIA**

***Distributed by***

**OIL WELL SUPPLY CO.**

*When writing* FRANKLIN VALVELESS ENGINE CO. *please mention The Petroleum Engineer*

## American Tank Has New Shop

THE American Tank Company, with headquarters at Oklahoma City, has constructed a new shop. It is said to be one of the most complete welding shops in this part of the country. It is a 140 by 260 by 50 feet, all steel frame, entirely welded together. The new shop is at 2121 Westwood Ave., Oklahoma City.

## New Type "C" National Separator

THE new type "C" National Separator has been designed by the National Tank Company, Tulsa, Okla., to fill the need of an efficient, low-priced separator that would handle the small producer or pumping well.

Simplicity of operation was given particular attention in the construction of this separator. No equipment was used that would require sensitive adjustment. All parts are self-contained within the separator. They possess an unique baffin arrangement that gives separation at minimum pressures.

## St. Louis Office for Merco Nordstrom

AN office has been opened in St. Louis, Mo., by Merco Nordstrom Valve Company, San Francisco, for the purpose of serving the trade in that territory. It is under the management of Leonard J. Kanard and is located at 317 North Eleventh st.

## Changes in the American Tank Company

H. E. BURNS, formerly general manager of the American Tank Company, Oklahoma City, is now in charge of the export division of Black, Sivalls & Bryson, Inc., and all subsidiaries. He is still maintaining his headquarters at Oklahoma City.

G. Raymond is now vice-president and general manager of the American Tank Company. C. B. Taylor is secretary-treasurer and resident manager.

## Vapor Recovery Systems Appoints Agent

THE Vapor Recovery Systems Company, 2820 N. Alameda St., Compton, Calif., has recently appointed Neilan Company, Ltd., exclusive sales agents in all oil territory except the Pacific Coast for its line of vapor conservation, vapor recovery and tank equipment which it manufactures under the trade name of "Varec". The Neilan organization manufactures a complete line of regulators for oil industry service.

## Rieber Instrument Corp. Increases Territory

PLANS are being completed by the Rieber Instrument Corporation of California to begin operations in Texas, Wyoming and Canada, according to J. C. Ballagh, general manager. Surveying engineers in the employ of the Rieber organization plan to contact these various territories and offer the same type of service as is rendered in California.

## New All-Steel Rotary Hose

MacCLATCHIE MANUFACTURING COMPANY, Compton, Calif., has introduced a new all-steel rotary hose, which, MacClatchie officials state, has an unobstructed fluid course, adequate strength, and perfect control under high pressures as its outstanding features.

The hose is made of hardened nickle steel joints and lengths of hydraulic steel pipe—pipe with gradual hydraulic bends. It is designed so that it can be placed in every practical position without binding or becoming cramped. MacClatchie officials claim it to be leakproof and blowout-proof. It is tested to 5000 C. W. P. before being delivered.

Minimum friction and positive swiveling is assured by hardened steel balls being ground in on each joint the manufacturer states. A double seal is given each union by two packing rings moulded according to a formula of MacClatchie. The connections are lubricated by the Alemite system. They are strung up on a one-half inch steel cable. Each section of hydraulic pipe is 7½ feet long and assemblies of any number of lengths can be made up. Those made up of five sections, 37½ feet long, are standard. The sections may be either two and one-half or three-inch pipe.

A complete folder has just been printed. It gives all details, specifications and installation instructions. It will be sent upon request by the company to those interested.

## AL-N-OL Kickless Brake Attachments

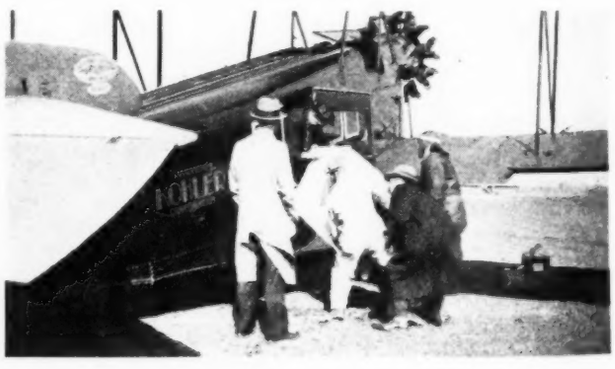
THE Allen-Oliver Company, Inc., Los Angeles, Calif., has added another new product to its line of oil field equipment. This device, known as the AL-N-OL Kickless Brake Attachment, is made in two types—the Wedge Type and the Screw Type.

The Wedge Type brake attachment can be attached to the brake band of any calf wheel or hoist. It acts as a go-between and is said to overcome the kick which is common to the ordinary type of brake where the lever is attached directly to the band.

The Screw Type can be installed on any present type of draw works. It is a self-contained unit mounted on a bedplate. It also prevents the kick-back.

## Louis Allis Frequency Converter Sent by Plane

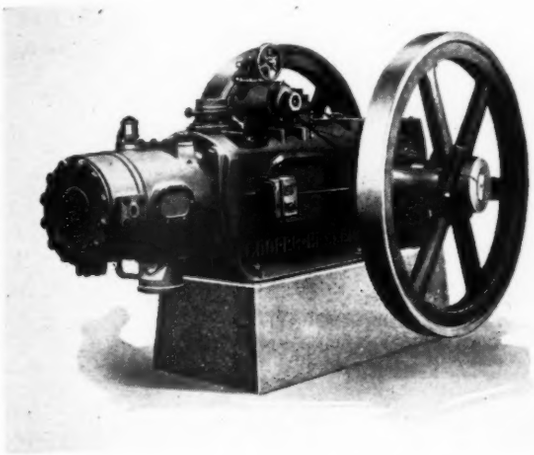
THE Louis Allis Co., Milwaukee, Wis., recently shipped one of its 650-pound, three-kilowatt generating unit and a five-horsepower driving motor mounted together on a structural steel base, known as a frequency converter set by airplane.



Within 90 minutes after leaving the Lous Allis factory the converter had been rushed to the airport by auto and thence through the air to Grand Rapids and to its destination by automobile. This is believed to be the first airplane shipment of heavy electrical equipment.

## New Engine by Cooper-Bessemer

ANNOUNCEMENT of an entirely new pumping and drilling engine, to be known as "Type G. A.," has been made by The Cooper-Bessemer Corporation of Mt. Vernon, Ohio. Sizes are 30 and 40 B. H. P.



According to the builders, the new engine combines all the good points of the old "Type O. F." (36,000 in service) with six major improvements listed as follows: Improved main roller bearings; die-forged crank shaft; stronger and more rigid main frame; greatly improved governor; improved piston rod packing; safety stop operating on ignition.

## New Remote Type of Brown Instruments

THE Brown Instrument Company of Philadelphia has developed a new remote type instrument line that is said to meet all requirements of indicating, recording and controlling pressures, liquid levels and flows at distances beyond the ordinary range of gauges.

These instruments are described in a new catalog, No. 7501, being distributed by the company. They are designed on the inductance bridge principle used in the Brown Electric Flow Meter.

A number of applications of these instruments are given in the catalog for use at the wells, pumping stations and pipe lines, or refineries. The company engineers are also available for working out the details.

## Chaplin-Fulton Regulators

A NEW pamphlet of the Chaplin-Fulton Manufacturing Company, Pittsburgh, Pa., describes various regulators, such as the High Pressure or Reducing Regulator, The Fulton Low Pressure Regulator with Automatic cut-off, and the Duplex Sensitive Gas Governors or Regulators for Manufactured Gas.

In addition a price list is given on the different sizes, while a capacity table gives the approximate capacity of the various regulators. Directions for setting the regulators are also discussed.

## New Lincoln Electrode

THE Lincoln Electric Company, Cleveland, Ohio, is marketing a new welding electrodex for use on light-gauge material which will be known as "Lightweld".

It can be used on 16, 18, 20 or 22 gauge in making a lap, butt or corner weld. It was designed to be used with a manual carbon arc and with from 30 to 60 amperes direct current and is suitable for horizontal, vertical or overhead work. The size of the rod is $\frac{1}{16}$-inch in diameter and 30 inches long and is put up in 10-pound containers.

## Welders Association Organized

ORGANIZATION of the Southwest Welding Association at the North Texas Agriculture College was effected at the recent gathering of welders and equipment men at Arlington, Texas.

In addition to performing routine duties of such an organization, the association will keep its members informed of new methods and materials, as well as conduct experiments at Arlington. However, the greatest good will probably come from the decision to make the organization a clearing house for employment.

W. Mike Murphy, of the Missouri Valley Gas Co., is the association's first president, and M. C. Stone, assistant director of engineering and trades at the school who has done much constructive work in the southwest welding conference, is secretary and treasurer. Headquarters will be maintained at Arlington. W. S. Mosher, Jr., of Mosher Steel & Machinery Co., is first vice-president, and C. J. Schram, Riverside Boiler & Welding Co., second vice-president.

## Two Recent Developments in Metering Equipment

THERE are two recent developments in metering equipment, states "Gas Measurement Engineering," a publication of the American Meter Company.

These are the Totalizing Demand Meter and Tandem Apparatus for Continuous Gas Sampling. Besides pictures complete diagrams and descriptions of the two pieces of equipment are given.

The Totalizing Demand Meter totals the demands of the meters in a battery and relays the summation a recording demand device. The Continuous Sampler is designed to divert a given proportion of the total quantity of gas measured by the wet station meter. The diverted gas passes through a governor and small wet meter and is stored in a gasometer for test purposes.

## Electric Welding Electrode Holder

THE Stoody Company, Whittier, Calif., has perfected and placed on the market a holder for electric welding electrodes. The completed holder weighs but one pound

and one ounce, yet is constructed of a steel forging with a turned composition fiber handle.

The method of attaching the conductor cable to the holder is most unique, in that it requires no sweating in or soldering and yet the cable is firmly attached and an excellent electrical connection is always insured.

One of the principal features of this holder is the fact that it is designed with narrow jaws, which permit using the electrode up to less than 1½ inches in length and this bit of unused electrode falls out as the new electrode is inserted.

The Stratford Engineering Company, Kansas City, has issued Bulletin No. 101, describing the Dispersion Contactor, used for continuous treating both light and heavy oils.

# MECHANICALLY COATED AND WRAPPED PIPE NOW HAS THE CALL

**NO OTHER improvement in the past twenty-five years has meant so much to pipe-line owners as the new Hill, Hubbell & Company Process of Mechanically Coating and Wrapping the pipe at the mill.**

**Pipe so protected can be shipped any distance and arrive in the field in perfect condition to weld and roll into the ditch. The protective coatings of Biturine, in turn protected by layers of felt and heavy Kraft paper, insure years of uninterrupted service — free from replacement and reconditioning costs.**

**Mechanically coating and wrapping pipe at the mill gives much greater protection than any other method. First, the pipe is thoroughly cleaned of all mill scale and rust; it is not only dry but *warm* when the primer is applied. Then two hot coatings of Biturine are put on, thus insuring freedom from pin-holes and bubbles. The felt is next applied under high tension, perfectly spaced, and this in turn is covered with the heavy Kraft paper — also under tension — thus providing extra protection to the pipe from mill to field.**

*Ten-inch pipe—mechanically coated and wrapped at the mill—strung down hill from Aromas, California, about six miles from Watsonville. Coast Counties Gas & Electric Company.*

*When writing* HILL, HUBBELL & CO. DIV. OF GENERAL PAINT CORP. *please mention The Petroleum Engineer*

*Compressor testing ten-inch pipe—mechanically coated and wrapped—about one mile east of Watsonville, Calif. Coast Counties Gas & Electric Co.*

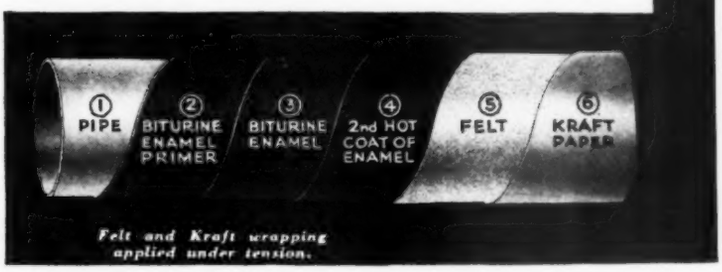
**The economy and advantages of the Hill, Hubbell & Company Process of Mechanically Coating and Wrapping pipe at the mill are recognized by leading pipe-line operators. Thousands and thousands of miles of pipe so protected have already been installed in all parts of the country. Specifications for many of the new lines now under construction call for pipe protected by the Hill, Hubbell & Company Process.**

**The Hill, Hubbell & Company plants are equipped to coat pipe up to 24-inch diameter by the Hill, Hubbell & Company Process. We can make the number of machine-applied hot coatings conform to any specifications covering a wide range of combinations and materials.**

**BITURINE COATINGS**

**Biturine Enamel — Biturine Solution No. 5**
**Biturine Enamel Primer — Biturine 70-30**
**Biturine Coupling Mixture**

***Biturine Enamel and Primer are perfectly adapted to the Hill, Hubbell & Company Process of mechanically applying coating to the pipe at the mill.***




*Felt and Kraft wrapping applied under tension.*

**Plants for the mechanical coating and wrapping of pipe are located in the following cities for the production of the pipe manufacturers listed below:**

| *Location* | *For production of* |
|---|---|
| Ambridge, Pa. | Central Tube Co. |
| Ambridge, Pa. | Spang-Chalfant & Co. |
| Indiana Harbor, Ind., | Youngstown Sheet & Tube Co. |
| Lorain, Ohio | National Tube Co. |
| Milwaukee, Wis. | A. O. Smith Corp. |
| Youngstown, Ohio | Youngstown Sheet & Tube Co. |

**Our nearest office will be glad to send literature describing the Hill, Hubbell & Company Process of mechanically wrapping and coating pipe, giving full details and specifications.**

# GENERAL PAINT CORPORATION

HILL, HUBBELL & COMPANY DIVISION

*Specialists in the science of protective coatings for all industries*

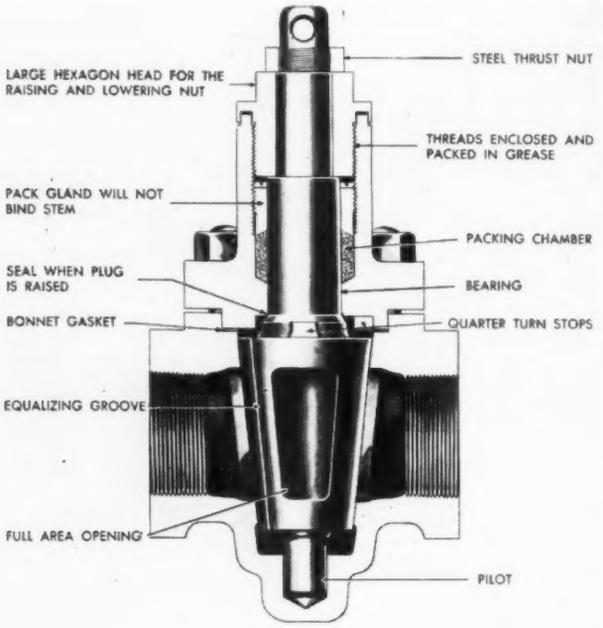
Chicago—105 West Adams St. New York—11 Broadway San Francisco—160 Fremont St.
Seattle—1406 Dearborn St. Los Angeles—908 South Main St.
Portland, Ore. Tulsa, Okla. Houston, Texas Dallas, Texas Spokane, Wash.

Export Department:
*Head Office*—160 FREMONT ST., SAN FRANCISCO, CALIFORNIA *Branch Office*—11 Broadway, New York, N. Y., U. S. A.

## Michigan Valve & Foundry Company Buys Columbus Valve & Manufacturing Co.

THE latest move in Michigan Valve & Foundry Company's carefully planned expansion program has been the acquisition of the business, plan and assets of the Columbus Valve & Manufacturing Company of Columbus, Ohio, makers of plug type valves.

The plug type valves now being manufactured under the present organization has an extremely wide range of pressures and incorporates developments not found in any other plug type valve, the maker states—developments of especial interest to the petroleum and natural gas industries, to the process industries generally and to the steam power plants—in fact for any work where pipe pressures and velocities are high or where high pressure is accompanied by high temperature conditions.




This valve is a valuable supplement to the extension line of standard gate valves, sluice gates and hydrants which have given Michigan Valve & Foundry Company wide recognition in the water works and engineering construction fields. It offers men in these fields greater possibilities in meeting special fluid control problems.

The industrial user of the plug type valve will, according to the manufacturer, likewise find greater latitude in his valve selection and the customary economic advantages resulting from the large-scale manufacturing operations by an organization which has had 78 years of continuous experience in the manufacture of valves, together with one of the most modern plants in the industry.

The Michigan Valve & Foundry Company are licensees under the Meehanite Metal patents and are using this metal generally and very successfully throughout their manufacturing operations. Consequently the very desirable physical qualities of Meehanite, especially its greater density and exceptionally high strength at elevated temperatures, will be utilized to extend the working range of both Michigan Plug Valves and Michigan Gate Valves. And as Meehanite has already won the endorsement of many of the ablest engineers in the oil fields and in manufacturing plants for its remarkable capacity under the severe service conditions, the announcement of its use in these valves will meet with widespread approval.

The Columbus plant will continue to be used exclusively for plug valve production, while the gate valves, sluice gates and other Michigan products will be handled by the Detroit plant. The operations of both plants will be directed by R. J. Goldie, the company's general manager. Executive offices remain in Detroit.

## New Westinghouse Electric Motor

A NEW electric drilling motor designed particularly for deep well drilling has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The motor is of the star-delta protected type, rated 125-250 horse-power, 900 revolutions per minute. The star side is used for drilling and the delta side for hoisting operations.

The large drilling motor is directly connected to, and mounted on a common bedplate with a single reduction gear, which carries a sprocket for chain drive to the line shaft.

## Murray Tool Moves Tulsa Office

THE Murray Tool and Supply Company's office in Tulsa, Okla., has been moved from 222 East Brady St. to the 19th floor of the Philtower Bldg., affording larger quarters.

The Murray Tool and Supply Company on April 22, purchased a Cessna Cabin Monoplane and up to June 19th it had been flown 154 hours with an average speed of 125 miles. It is used for transaction of company business, service calls and emergency trips.

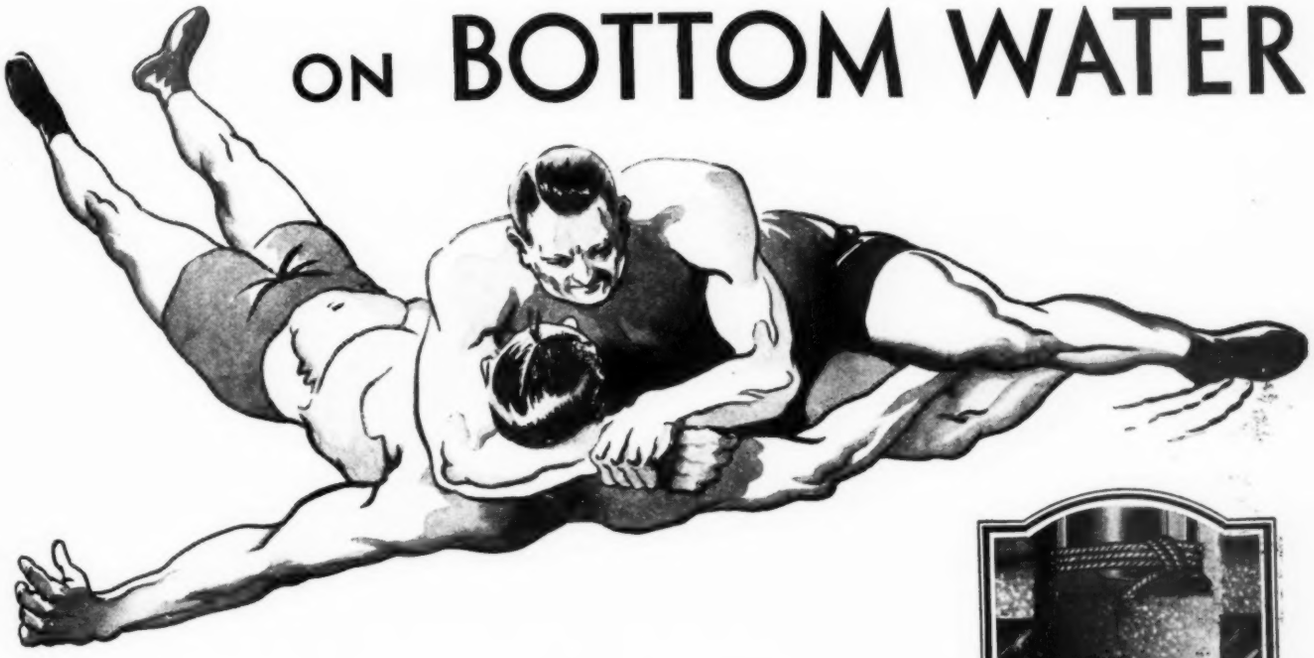
## New Baash-Ross Casing Tong Return

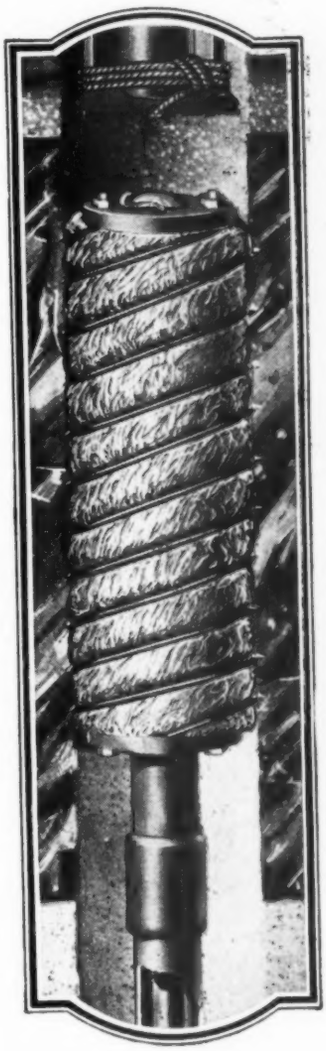
A COMPACT, quick-acting tool for returning casing tongs to position for the next pull, which offers a large degree of safety, and a great saving of time, according to the manufacturers, has just been placed on the market by the Baash-Ross Tool Company, Box 1297, Arcade Station, Los Angeles, from whom complete information may be obtained.

The new Tong Return consists of a length of double extra heavy pipe in which is installed a chain pulling against a suitable coil spring. The chain passes out the lower end of the tool over a sheave and its free end is attached to the tong handle. The chain has a travel of seven feet, and when pulled forward by the tong handle compresses the spring sufficiently to bring the tong back to normal position after the pull is released.

A latch tripped by a rope locks the chain in any desired position when slack is required to permit removing the tong from the pipe. The latch is automatically released when the tong is again placed on the pipe and a forward pull taken. This tong return is suspended from a derrick girt in the corner opposite the crank, and is easily moved from rig to rig.

# GET THAT "GUIBERSON HOLD" ON BOTTOM WATER





IF wrestlers had such a hold they would probably call it the "screw hold". . . resulting in stoppage of circulation, suffocation and complete deadness "from there on down." That is what happens to bottom water when the Guiberson Plug is applied.

When the Guiberson Plug is set in place, steel spirals bite into the walls of the well, taking a screw-like grip that no pressure from below can budge. Oakum between the spirals makes a packing that will not allow a drop of water through and will outlast the well. There is no more wrestling with the troubles of bottom water after a Guiberson Plug is put in place. Fully Patented.

*"Better Be Safe Than Sorry"*
**THE GUIBERSON CORPORATION**
**Box 1106, Dallas, Texas**
*California Branch:* 1506 Santa Fe Ave., Los Angeles
621 Kennedy Bldg., TULSA — 321 S. Osage St., PONCA CITY — 506 Trust Bldg., NEWARK, O.

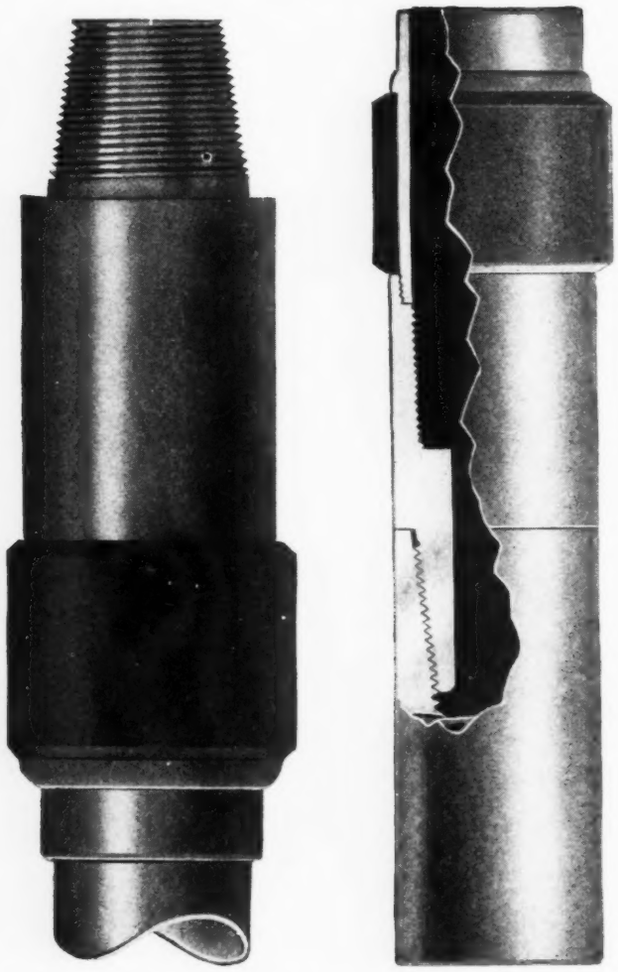
# GUIBERSON

BETTER BE SAFE THAN SORRY

*When writing* THE GUIBERSON CORP. *please mention The Petroleum Engineer*

## Brewster Frictionless Tool Joints

THE Brewster Company, Inc., of Shreveport, Louisiana, is placing on the market a frictionless tool joint. The friction guard fits into a milled groove on a specially built tool joint of the regular Brewster API standard. It is made from the highest grade alloy steel, heat treated, with



milled threads. The rubbers are made of hard frictionless rubber of two pieces, which are easily removed and replaced. The ferrule is threaded left-hand and by three turns to the right releases the rubber for replacement. Details and prices may be obtained from the company.

## Study of Natural Gas Flow

AN investigation of the fundamental relations involved in the flow of natural gas through gas sands and of the relationships between gas flow and gas well capacity is being conducted at the Petroleum Experiment Station maintained by the United States Bureau of Mines, Department of Commerce, and the State of Oklahoma, at Bartlesville, Oklahoma.

The basic thought of the fundamental relation between the three factors, (A) rock or formation pressure in the sand, (B) back pressure at the sand face of the well, and (C) the rate of flow from the well, is that the sand of any particular gas well can be calibrated for its capacity to deliver gas from any formation pressure into any back pressure. In other words, a straight line relation between rate of flow and the difference of the squares of the formation and back pressures should be applicable throughout the producing life of a gas well.

## B. S. & B. Vapor Pressure Wood Tank

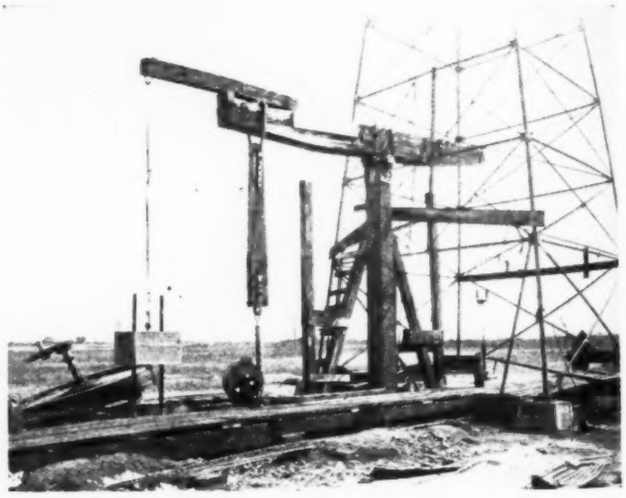
AFTER more than two years of observation on a test tank, Black, Sivalls and Bryson, manufacturers of tanks, with headquarters at Bartlesville, Okla., have brought out a tank to combat the troublesome problem of curbing the effects of hydrogen sulphide gas fumes found in sour crude in West Texas and the Panhandle fields. It is known as the B. S. & B. Vapor Pressure Wood Tank, which is constructed very similar to the B. S. & B. vapor pressure bolted steel tank. The wood vapor tank is supported by tie rods on the inside and is built to withstand a pressure of sixteen ounces and a vacuum of two ounces under working conditions, with a reasonable factor of safety.

The tank is built of redwood, which, according to the company engineers, is a material especially impervious to the action of hydrogen sulphide gases of sour crude. The inside of the tank is so constructed that no metal is exposed to the oil or to the hydrogen sulphide gas fumes. Every metal part, used to give the tank rigidity and strength, is insulated with wood.

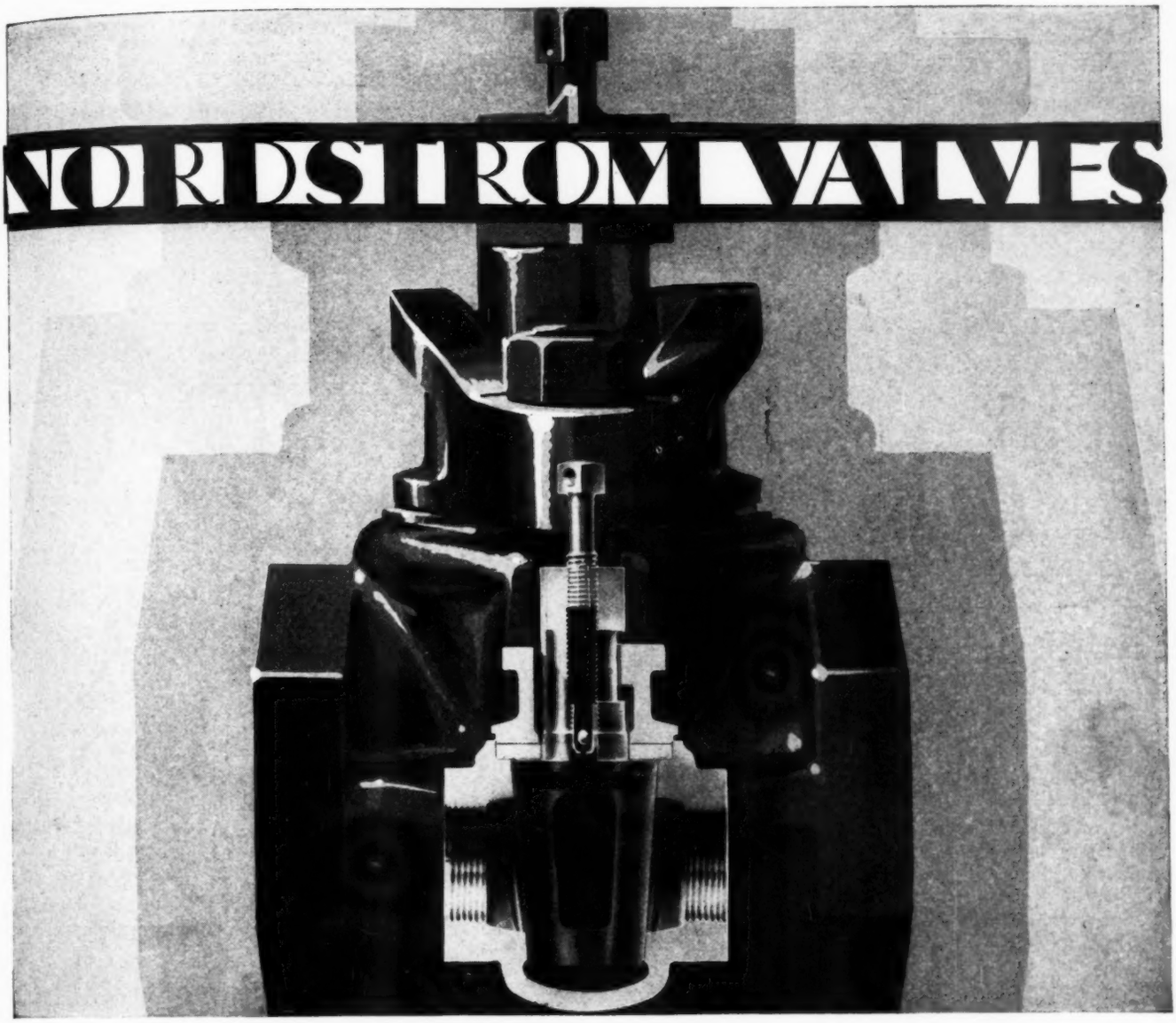
The new tank is being manufactured at the company's plant at Borger, Tex., and will be manufactured also at the new wood tank plant which is now under construction at Odessa, Tex. The tank is made in 250, high 500, low 500 and 1,000-barrel sizes.

## The Pulling Mule

THE Producing Equipment Company (James R. Cole), Tulsa, Okla., recently started marketing a "mule" for operating the walking beam of a pumping well through a rod line. The mule can be used for pumping deep or heavy wells, or wells where it is desired to use a long stroke. The movement imparted to the walking beam through the mule is that of a simple, steady movement at constant angular velocity, and in action is exactly like that of a walking beam operated by a pitman connected directly to the crank.



The mule, according to Cole, cannot be pulled out of alignment, requires no expensive foundation, is easily set even by unskilled labor, and the power deflector is swiveled on its base so that the rod line can come to it at right angles to the rig or from any other direction. The swivel feature permits the power deflector to constantly align itself in the same plane of movement with that of the tension on the walking beam and on the rod line.




# › › › *Lubricant Displaces Force*

MERCO

THE PERFECT APPLICATION OF A PRINCIPLE

"MERCO" Lubricants assure best valve performance. We make a complete line adapted to many valve services. "MERCO" Pipe Compound permanently stops leaks in joints, gaskets, etc.

**Lubricant displaces force in the operation of the Nordstrom Valve. Hydraulic pressure actuated by simply turning a set screw forces the lubricant through a hole in the shank of the plug and through grooves alongside of the plug to the bottom of the valve—lifting, lubricating and sealing the valve.**

***Nordstrom Valves resist sticking and leaking. They are made of different metals for various services in the Petroleum Industry.***

SOME USES IN THE PETROLEUM INDUSTRY

Concentrated Sulphuric Acid
Hot Distillates
Asphalt
Crude Oil
Naphtha
Mud Pump Lines
Pump Manifolds
Boiler Blow-Offs
Dilute Sulphuric Acid
Gas Fuel Lines
High Pressure Gas
"Christmas Trees"
Etc.

***Nordstrom Valves for the particular requirements of the Petroleum Industry are fully illustrated and described in latest Catalog. Yours for the asking.***

**MERCO NORDSTROM VALVE COMPANY**
SUBSIDIARY OF THE MERRILL COMPANY . . ENGINEERS

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**Agencies:**

**Denver** - Republic Supply Company, 832 Continental Oil Bldg.
**Honolulu** - W. A. Ramsay Co., Ltd., Fort & Queen Streets
**Manila** - E. W. Sharp, c-o J. A. Murphy Co. Perez Semanillo Bldg.
**Tulsa** - B.V. Emery & Company, 216 E. Brady Street
**Philadelphia** - Brown, Wilson & Company, 1600 Arch St.
**Saginaw** - Arthur C. Beckert, 112 Durand Street
**Salt Lake City** - National Equipment Co., 101 West 2nd South St.

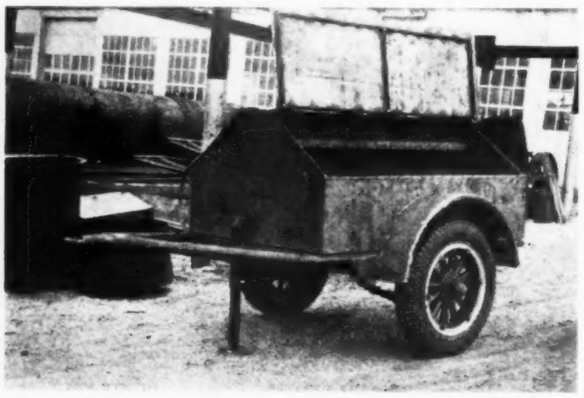
**Factories in U. S.** Oakland, Calif. and Belleville, N. J.
**Canada** - Peacock Bros., Ltd., Montreal, Toronto, Winnipeg, Vancouver. (Also Sydney, N.S.)
**England** - Audley Engineering Co., Ltd., Newport, Shropshire.
**Buenos Aires, Argentine,** - General Electric, Soc. Anon., Victoria 618 Esq. Peru.

*When writing* MERCO NORDSTROM VALVE CO. *please mention The Petroleum Engineer*

## Gas Company Uses Heavy-Duty Tool Box

THE heavy-duty metal tool box mounted on a trailer was built by the Oklahoma Natural Gas Corp. at its Tulsa (Okla.) machine shops for field service. The box is six feet long, four feet wide, 30 inches high at the center and 16 inches high on the sides.

It was made with No. 12 sheet iron welded together. The lid is braced all around the edges with half-inch pipe



**Side view of tool box, showing tray in the top.**

and the corners and edges on the inside are braced with three-quarter-inch pipe. At the top and on each side of the box are trays for small tools and parts. To prevent rain from getting inside the box the lid edges have been turned on the bottom and edges and the corners turned. The box is bolted to the trailer frame and the hinges have been tack-welded on.

One of the features of the trailer is that it is equipped with a stiff leg on both the front and rear ends. When on the road the stiff legs are raised and held up with a bolt. Another of the features is that the trailer hitch has been

**Hard facing on trailer hitch.**

hard-surfaced. The top and bottom side of the hitch, which are subject to the most wear, have been covered with a hard surface material to reduce wear at these two points.

The trailer also was made in the shops and was designed for half a ton capacity with a ton overload rating. The frame was built with two-inch pipe and is equipped with 30-by-5 tires.

## Pennsylvania Air and Gas Compressors

BULLETIN No. 100, has been printed by the Pennsylvania Pump and Compressor Company, Easton, Pa. It describes the company's single stage and duplex air and gas compressors. All of the principal parts of the compressors are illustrated and described.

## Chaplin-Fulton Valve Bulletin

THE Chaplin-Fulton Manufacturing Co., Pittsburgh, Pa., has a new bulletin describing its Fulton Lever Safety Valves and Fulton Dead Weight Safety Valves. Uses and specifications, as well as illustrations, are to be found in the pamphlet.

## Dreadnaught Loose-Leaf Pamphlets

THE Beaumont Iron Works Company, of Beaumont, Texas, has out several pamphlets on items of Dreadnaught equipment. These are loose-leaf form and replace several pages in the present Dreadnaught catalog. Catalog 34, covering swage nipples, is also ready for publishing.

## Natural Gas Equipment Literature

COMPLETE literature descriptions of the Natural Gas Equipment, Inc., of Los Angeles, Tulsa, and San Francisco, has been received. This includes the NGE Gas Burners, Wilgus Pressure Regulating Equipment, Anubis Differential Pressure Recorders and NGE Liquid Level Controllers.

A new piece of equipment announced in the five pamphlets is the Anubis Differential Pressure Recorder.

Each one of the mentioned equipment in the first paragraph is carefully discussed in the pamphlets. Another pamphlet of the company lists 21 gas burner problems and their solutions.

## New Pipe Protection Booklet

A BOOKLET on "The Protection of Oil and Gas Lines" is just off the press and is being distributed by the Wailes Dove-Hermiston Corporation, New York City. One chapter is devoted to illustrations showing that practically all of the largest oil and gas trunk line systems have been safeguarded against corrosion.

## Declination-Recorder of Bore-Holes

THE Bore-Hole Declination Recorder of the Gesellschaft fuer nautische Instrumente is an instrument to discover crooked drill holes and also to find the correct position of the hole at any moment during the process of drilling.

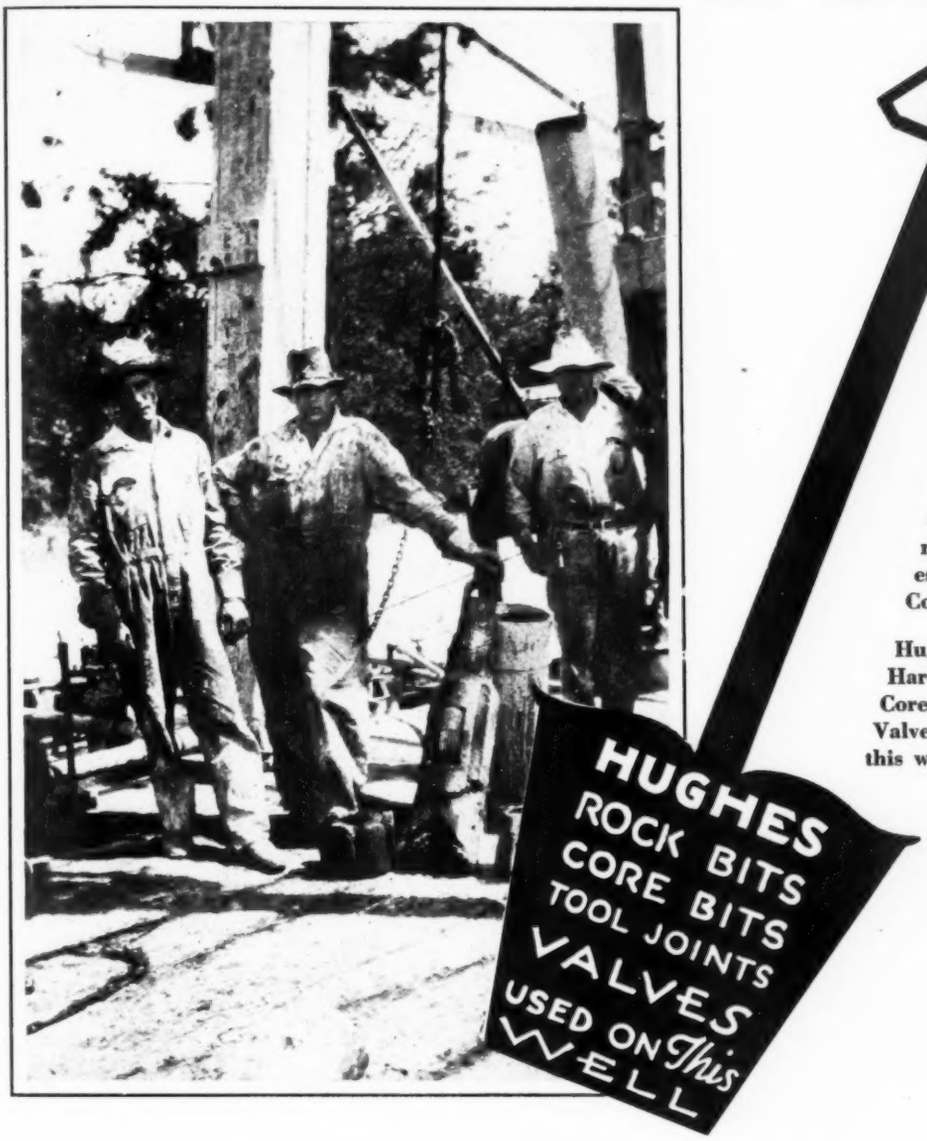
It is claimed by the makers that the accuracy of the instrument is so great that the location of the bore-hole in a depth of 1000 meters (3300 feet) can still be given with an accuracy of about 50 centimeter.

Details on the instrument may be secured from Erwin Goldschmitt, American representative, at the Southland Hotel, Dallas, Texas.

## Petroleum Equipment Company Catalog

THE Petroleum Equipment Company of Texas, Inc., of Fort Worth, has issued Catalog No. 2, which gives specifications and prices of Nu-Alloy specialized balls and seats and Nu-Steel balls and seats. It also illustrates and describes the Petro oversize standing valves; the new "Safte Lock" traveling block; steel oil well working valves; polish rod, and other equipment.

# *Another Record of Superior Performance of* HUGHES TOOLS




**This photograph shows the rig on Texas Company's Rayne Heirs No. 5 Well, Evangeline Field, Arcadia Parish, Louisiana.**

**Being well below 8000 feet and still drilling — this well ranks among the deepest holes in the Gulf Coast.**

**Hughes Rock Bits, Cones, Hard and Soft Formation Core Bits, Tool Joints and Valves are being used on this well.**

**Contractor: S. Rhodes. Superintendent: A. B. Patterson.**

**Hughes Tools**
**Sold by Supply Stores Everywhere**

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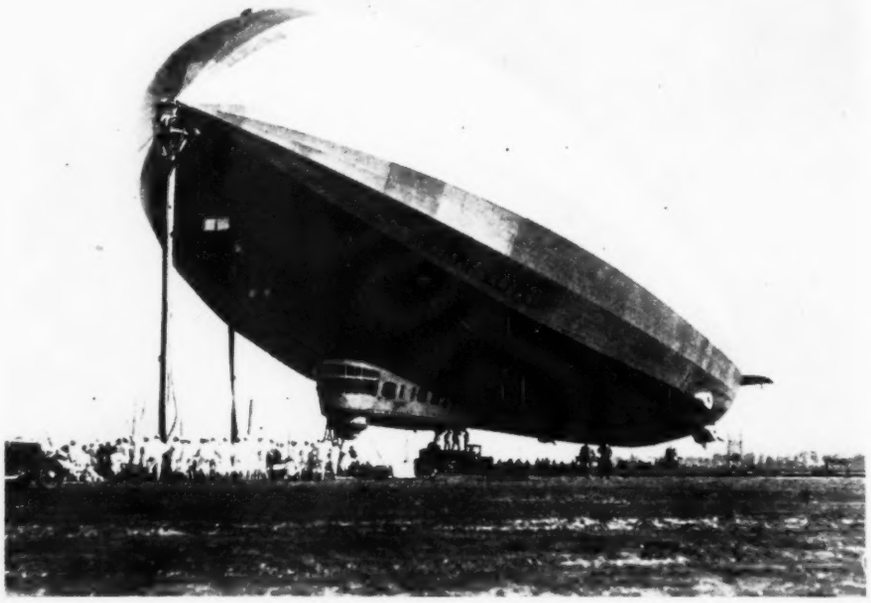
*When writing* HUGHES TOOL COMPANY *please mention The Petroleum Engineer*

# Hydrocarbon Gas As Power *in the* UNITED STATES[1]

By GUSTAV EGLOFF[2]

IN THE use of fuel in the United States, a change is occurring that is truly revolutionary. In home and factory alike tremendous quantities of gas are replacing coal. The cleanliness and adaptability of gas combustion gives gas signal advantages over other carbonaceous fuels. Over 2,800,000,000,000 cubic feet of gas were consumed in the United States during 1929. Of this quantity eighty per cent came from the natural gas and petroleum industries, and was made up of natural gas, still gas and gas from the cracking process.

Natural gas, long used extensively, is now finding still wider distribution as large capacity pipe lines are being laid to transport the gas from distant fields to great centers of population. Some pipe lines convey gas to cities hundreds of miles from the sources of production. One line transports gas over four hundred miles, and another is proposed which will extend a thousand.



From American Gas Association

**Fueling Graf Zeppelin at Los Angeles**

Recognition and utilization of the value of the gases generated in the distillation and cracking of oil are rather recent developments, but are now becoming general.

The 1929 production of natural gas and refinery gases is estimated at 2,320,000,000,000 cubic feet. This volume was made up of 1,800,000,000,000 cubic feet of natural gas, 270,000,000,000 cubic feet of petroleum distillation gases, and 250,000,000,000 cubic feet of gas from the cracking process. At the points of consumption the value of the amounts of the three gases produced in 1929 was over $500,000,000. Much of this gas came into direct competition with coal. The amount consumed as fuel had a heating value equal to 92,000,000 tons of coal. Thus the natural and petroleum gas consumed in the United States for fuel purposes is equivalent to one-sixth of its coal production.

From the standpoint of the well-being of city populations, the replacement of coal by gas is a tremendous gain. The soot produced in our cities through the burning of solid fuels is a burden of magnitude. The use of gas results in a great economic saving, and is a true conserver of health.

It is estimated that smoke causes an annual loss to the United States of over $500,000,000. The loss for each city dweller, due to soot from burning coal, is approximately $15.00 per year. The damage done by smoke is of many types. It vastly increases expenditure for laundry and dry cleaning. It impairs merchandise, paint, metal work and the surface of buildings, it adds to the labor of housekeeping, and is an incalculable detriment to the nerve force and health of the nation.

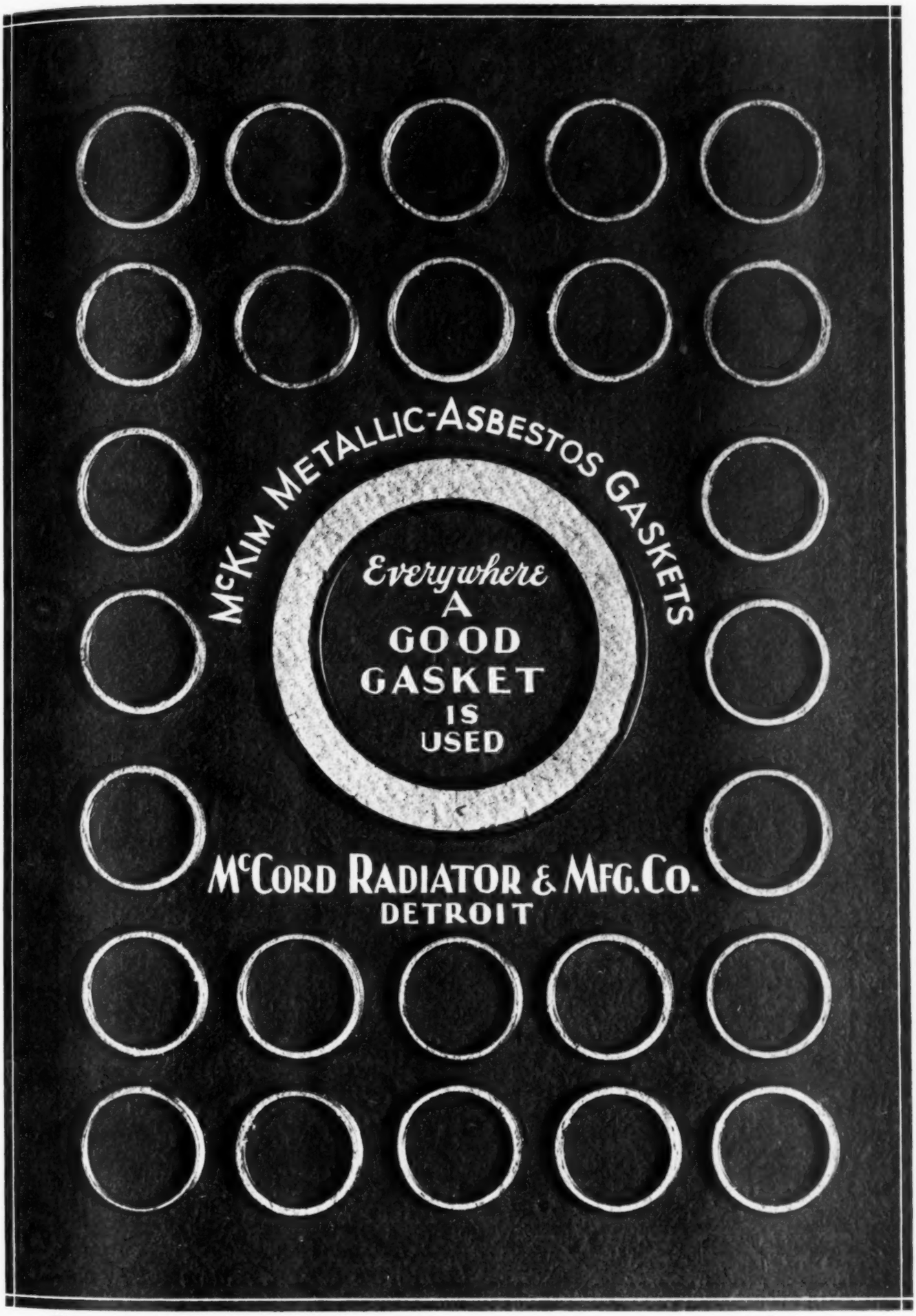
Studies of the smoke problem in our great cities have yielded astonishing results. In Chicago a survey showed that the dust-fall, which is largely though not entirely due to products of coal combustion, was as high as 460 tons per month per square mile. In Pittsburgh a deposition of 1,000 tons of solids per square mile per year has been reported. Here it was found that eliminating dense smoke did not solve the problem, as the dense smoke amounted to but a small part of the solids leaving the smoke stacks. When increased draft was used to prevent dense smoke, the total solids ejected increased fifty per cent. Even perfect combustion of coal will not eliminate the deposition of solids in our cities, for this fuel contains a large percentage of ash, which pollutes the atmosphere when coal is burned.

The great losses due to smoke—the monetary waste, the increased labor needed on account of soot, and the impaired health and nerve force of our city dwellers—would be eliminated by the use of gas for domestic and industrial fuel, due to its smokeless and ashless combustion. In the interests, therefore, of cleanliness and of public health, the use of gas must not only continue at the present rate, but must increase at an accelerated pace.

### *Gas and the Coal Industry*

At first glance it would seem that the coal producers must view with alarm the rapid expansion of the use of natural and petroleum gases as fuel. However, closer study shows that if the coal producers read aright the signs of the times, and keep in step with the march of progress,

[1] Presented at the World Power Conference, Berlin, Germany.
[2] Universal Oil Products Company.



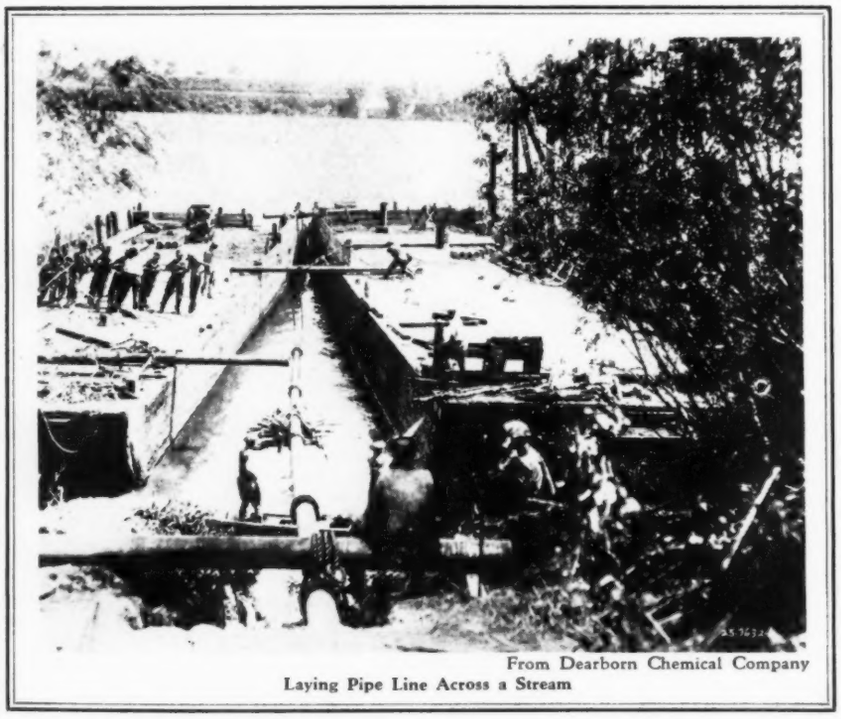

*When writing* McCord Radiator & Mfg. Co., Gasket Division, *please mention The Petroleum Engineer*

the increasing demand for gas offers them almost boundless opportunities.

To realize these opportunities to the utmost, carbonization, cracking and gas-making processes must join, and work together toward a common end—the conversion of coal into gaseous fuel and in addition gasoline of high anti-knock value.

The coal resources of the United States can furnish an almost incalculable amount of gas. By carbonization processes coal can be converted into gas, coke and tar. The tar can be converted by the cracking process into gas, gasoline and coke. The coke from both carbonization and cracking can itself be converted into water gas or producer gas. The erection and operation of gas and cracking plants at coal mines would be a great step forward. There would be but two products to ship from the mine—gas and gasoline. The gas would be piped to points of utilization, instead of shipping the coal itself. The feasibility of long distance piping of gas is not a matter of conjecture. Its practicability is fully proved by the present piping of natural gas for hundreds of miles. The motor fuel produced at the mine by the cracking process could also be pipelined to consuming centers. Gasoline pipe lines are already in service in the United States.

The conversion of coal into gas and gasoline at the mines by carbonization and the cracking process would enable the coal industry to keep abreast of the newer fuel developments.



From Dearborn Chemical Company

**Laying Pipe Line Across a Stream**

### *Uses of Gas*

Gas is a distinctive fuel, having special advantages for domestic use and specific industrial applications. The uses of the gas furnished by the natural gas and petroleum industries are many and varied. In the oil fields natural gas facilitates the raising of oil to the surface of the ground, and operates engines for drilling, pumping, and compressing gas in natural gasoline plants. The gas is used by nearly five million domestic consumers. Billions of cubic feet are annually consumed in manufacturing ceramics and glass, in smelting, working metals, burning brick, generating electric power and refining oil. The building of natural gas pipe lines making this fuel available in large amounts has stimulated the industrial development of every region into which the lines have penetrated.

Helium from natural gas has decreased tremendously the fire hazards of lighter-than-air craft. Natural gas fractions drove the airship Graf Zeppelin around the world. Liquefied portions of natural gas in pressure cylinders give the advantages of city gas to country homes.

Gas from oil stills is in demand for the enriching of manufactured gas for city use. The ever-increasing amount of gas furnished by the cracking process is used to carburet gas of low calorific value, as a refinery fuel, and in chemical synthesis.

### *Gas Production*

The amount of natural gas and petroleum gases reaches an almost incomprehensible figure. As shown by the table below, the production of natural gas in 1929 was more than three times that of manufactured gas. The combined volume of gas from petroleum stills and from the cracking process was greater than the entire manufactured gas output of the country.

***Production of Gas in 1929***

| | Cubic Feet |
|---|---|
| Natural gas [1] | 1,800,000,000,000 |
| Gas from petroleum distillation | 270,000,000,000 |
| Gas from the cracking process | 250,000,000,000 |
| Carburetted water gas [2] | 255,000,000,000 |
| Oil gas [2] | 32,400,000,000 |
| Manufactured gas, total (includes carburetted water gas, coal gas, oil gas and coke oven gas distributed by gas companies) | 514,000,000,000 |

[1] U. S. Department of Commerce.
[2] American Gas Association.

In amounts of natural gas produced, the leading states were, in 1928, in order, Oklahoma, Texas, California, Louisiana, West Virginia.

The recent growth of the use of gas in the United States has been amazing. There has also been rapid increase in the quantities of petroleum still gases and gas from the cracking process. This expansion in the use of gas is emphasized by the figures in the table below:

PRODUCTION OF COMMERCIAL GASES, 1919-1929
*(in thousands of cubic feet)*

| Year | Natural gas | Manufactured gas | Gas from petroleum distillation | Gas from the cracking process |
|---|---|---|---|---|
| 1929 | 1,800,000,000 | 514,500,000 | 270,000,000 | 250,000,000 |
| 1919 | 745,916,000 | 300,000,000 | 90,000,000 | 16,500,000 |

The commercial gases contain enormous quantities of the lower paraffin hydrocarbons. Propane and butane are also present in solution in commercial gasoline. The amounts of gaseous paraffins available from these sources are estimated in the following table:

AVAILABILITY OF LOWER PARAFFINS, 1929 [1]
*(in thousands of cubic feet)*

| | Methane cu. ft. | Ethane cu. ft. | Propane cu. ft. | Butane cu. ft. |
|---|---|---|---|---|
| Natural gas | 1,530,000,000 | 162,000,000 | 54,000,000 | 18,000,000 |
| Gas from crude oil refining | 164,000,000 | 56,700,000 | 32,400,000 | 8,100,000 |
| Gas from cracking | 137,500,000 | 45,000,000 | 12,500,000 | 5,000,000 |
| Carburetted water gas | 33,150,000 | 7,650,000 | 765,000 | ..... |
| Oil gas | 13,000,000 | 4,860,000 | ..... | ..... |
| Natural gas gasoline | ..... | ..... | 2,757,000 | 19,950,000 |
| Refinery gasoline | ..... | ..... | 4,688,000 | 17,830,000 |
| Totals | 1,877,650,000 | 276,210,000 | 107,110,000 | 68,880,000 |

There are thus present in these gases and in gasoline huge

[1] Based on Egloff and Schaad, Chem. Reviews 6, 91 (1929).

amounts of the paraffin hydrocarbons which are readily obtainable in pure form. The large amounts of propane and butane available are of particular interest, as these two hydrocarbons are now sold in steel cylinders and are finding a market for both domestic and industrial use.

### *Natural Gas*

#### Composition

As may be seen from the table, by far the most abundant of the industrial gases is natural gas. This gas almost invariably accompanies petroleum underground, and frequently occurs alone. The gas may be present in the earth apart from the oil strata, or it may be dissolved in the oil under the high pressures which exist in oil fields. These pressures range from a few hundred to above 2,500 pounds per square inch. When oil is produced, gas usually accompanies it, in amounts ranging from 200 to 20,000 cubic feet per barrel of oil. Some wells have produced 100,000,000 to 150,000,000 cubic feet of natural gas per day.

Natural gas is largely made up of the gaseous members of the series of paraffin hydrocarbons. It also usually contains considerable amounts of vapors of pentane and higher paraffins, and often nitrogen and carbon dioxide. In the table below are given analyses of typical commercial natural gases, as furnished to a number of American cities.

Typical Natural Gas Analyses[1]

| | Pittsburgh, Pa. | Cincinnati, Ohio | Los Angeles, Calif. | Bartlesville, Okla. |
|---|---|---|---|---|
| Methane | 84.7 | 79.8 | 77.5 | 92.4 |
| Ethane and higher paraffins | 13.7 | 19.5 | 16.0 | 3.1 |
| Carbon dioxide | ..... | ..... | 6.5 | 1.4 |
| Nitrogen | 1.6 | 0.7 | 0.0 | 3.1 |

More detailed analyses,[2] showing the hydrocarbons present in three natural gases, are given in the table below. The analyses were carried out by condensation and fractionation of the gas at low temperature.

[1] Technical papers 105 and 158, U. S. Bureau of Mines.
[2] Ind. Eng. Chem. Anal. Ed. *1*, 226 (1929).

Hydrocarbons Contained in Natural Gas
(*in per cent*)

| | | | |
|---|---|---|---|
| Methane | 85.7 | 65.8 | 41.4 |
| Ethane | 6.5 | 10.5 | 24.4 |
| Propane | 3.6 | 7.6 | 16.7 |
| Butane | 1.2 | 3.6 | 6.8 |
| Pentane | 0.5 | 1.6 | 4.9 |
| Hexane | Trace | 1.0 | 1.2 |
| Heptane | ..... | Trace | 0.1 |
| Carbon dioxide | 0.3 | 0.7 | 0.7 |
| Residue | 2.1 | 9.1 | 3.8 |
| B. T. U. per cu. ft. | 1131 | 1270 | 1755 |

These data do not by any means represent the composition of all natural gas. At times gas is found that is composed almost exclusively of methane. In other cases hydrogen sulfide or organic sulfur compounds are present. Gas containing more than ten per cent of nitrogen has been found in some localities in Kansas and Texas, in fact, in the latter state gas has been produced in which there was so much nitrogen that it was incombustible.

Certain wells in Kansas, Colorado, Wyoming and California yield gases containing a large proportion of carbon dioxide. The Walden well in Colorado when brought in produced 32,000,000 cubic feet of gas per day, which contained enough carbon dioxide to manufacture 1,500 tons of "Dry Ice" (solid carbon dioxide). This tonnage of "Dry Ice" is six times the amount now used for refrigeration in the United States.

### *Use of Natural Gas in Oil Production*

The first power use of natural gas is in crude oil production. Crude oil moves from the sand to the well and upward by reason of the pressure exerted by the gas associated with it. Moreover, gas dissolved in oil lowers its viscosity and surface tension, quickening its flow. It is stated that at 250 pounds pressure, oil will absorb 250 cubic feet of gas per barrel, and that oil saturated with gas at 600 pounds pressure has a viscosity but 42 per cent as great as under atmospheric conditions. In the ground, because of the large amount of dissolved gas, the oil may even approach the fluidity of kerosene. It is apparent that such gas-saturated oil will flow more readily than that containing little or no gas.

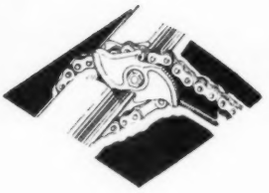
If gas escapes from an oil well without control it will leave the oil instead of driving it to the surface of the ground. Hence there will be an increase in the viscosity and surface tension of the oil, and a retardation of its flow. As a result the amount of oil recovered from the well will be less than that which would be obtained with controlled use of gas. The gas may even leave the oil in such quantity that the oil sand pores will be choked with gas and the flow of oil completely stopped. (Jamin effect.)

It is important that the amount of gas which leaves the well with the oil be as small as possible, in order to obtain the maximum quantity of petroleum from the oil sands. On theoretical grounds, Coleman, Wilde, and Moore have calculated that if the flow of gas is restricted to 480 cubic feet per barrel of oil, about fifty per cent of the oil in the sand will flow from the well. If 1,200 cubic feet of gas per barrel of oil are permitted to escape, the recovery is but twenty

From Hope Engineering Company

**Laying Pipe Line in Flooded Area**

# PIPE AND FITTINGS



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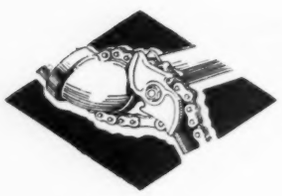

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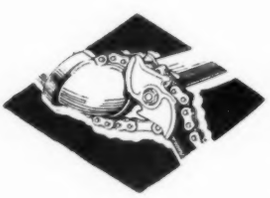

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per cent of the oil present, while if the gas flow is 23,000 cubic feet per barrel of oil, as it has been in at least one California field, but three per cent of the oil in the ground can be recovered by flowing.

The gas-oil ratio is kept low by flowing a well against back pressure. This pressure is obtained by causing the oil to pass through a restricted orifice, by maintaining pressure on the gas-oil separator, by using pumps with high fluid level, by proper size of tubing and by correct tubing depth. All wells cannot be handled alike. For each well there is a speed of production which will yield least gas and most oil, this rate depending upon the depth of the oil sand, the character of the oil, the pressure in the oil-sand reservoir, and the original ratio of gas to oil underground.

### *Gas Lift*

Another oil field use of natural gas is the bringing of the oil to the surface by the gas lift. The gas is compressed and forced down between the casing and tubing of the well. In part it dissolves in the oil, and in part mixes with it, carrying the oil to the surface. The use of the gas lift both increases the rate of production as much as four or five times and increases the volume of oil recovered. It has been estimated that between 40 and 45 per cent of the oil produced in the Seminole field, Oklahoma, having a market value of $100,000,000, was obtained by the use of the gas lift method of oil recovery. The gas lift is not always an unmixed blessing, however. When water is present, the churning together of water and oil by the gas gives rise to tenacious emulsions, in some cases increasing the emulsion formation from ten to over fifty per cent of the oil.

### *Repressuring*

After gas has left an oil stratum it cannot be pumped back and made to dissolve in the oil still below ground in the amount originally present. Nevertheless, oil production is greatly aided by returning gas to the oil sands, a process known as "repressuring". Gas compressed to pressures ranging from a few hundred to 1,500 pounds per square inch or more, is returned to the oil sands by designated wells, while production is continued from other wells nearby.

In repressuring, from 5,000 to 20,000 cubic feet of gas per producing well per day is ordinarily pumped into the oil sand. Either "dry" gas, from which gasoline vapors have been removed, or "wet" gas may be used. The gasoline vapors in the wet gas appear to have a scrubbing action that removes oil from the sand grains. By repressuring an oil sand area the drop in pressure underground is checked. As oil production is roughly inversely proportional to the rate at which pressure drops in the oil producing formation, this process notably increases the total flow of oil. Gains in total production of oil by repressuring have been reported of from 15 to 389 per cent.

### *Natural Gasoline*

The vapors of pentane, hexane and heptane contained in some natural gases are undesirable constituents when the gases are transported, as they condense in the pipe lines and tend to clog them. Moreover, they have value when condensed to the so-called "natural" gasoline. Natural gasoline makes up ten per cent of the motor fuel sold in the United States, and is produced at the rate of more than 1,500,000,000 gallons per year. Over ninety per cent of natural gas produced in the United States is passed through gasoline recovery plants.

### *Purification*

Before natural gas is put to any use above ground it should be freed from hydrogen sulfide. This substance occurs in the gas in amounts ranging from a negligible quantity to over ten per cent. If not removed it gives rise to unpleasant fumes when the gas is used for domestic purposes, it corrodes pipe lines, destroys the efficiency of natural gasoline absorbers, and injures gas engines and compressors. The hydrogen sulfide can be removed by scrubbing the natural gas with a solution of sodium carbonate. By another process free sulphur is recovered commercially as a by-product from the purification.

From Dearborn Chemical Company

**Coating Pipe Against Corrosion**

### *Transportation of Natural Gas*

Natural gas is carried throughout the United States by a system of widely distributed pipe lines. The total length of these lines is estimated at over 55,000 miles, and their value makes up a large share of the present investment in the natural gas industry of $1,900,000,000.

The supplying of natural gas to communities near oil and gas producing areas has been actively going on in the United States for over 50 years. But within the last few years the area served by natural gas has been greatly increased. Since the year 1925, a number of pipe lines from 100 to 400 miles in length and three to twenty-two inches in diameter have been constructed, to carry natural gas by billions of cubic feet per year to cities far from the gas fields. The map shows the gas pipe line network extending over the country. In Figure 1 is shown a view of one of these pipe lines after laying, but before being covered with earth. In 1930 an expenditure of $250,000,000 for increased distribution facilities for natural gas is expected.

One of the greatest of these pipe line projects is the twenty-two inch line completed in 1928 from Amarillo, Texas, to Denver and Pueblo, Colorado, a distance of 340 miles. The line required eight months to construct, and with the gas lands secured to assure a lasting gas supply, the total cost was $25,000,000. The line rises from 3,800 feet above sea level at Amarillo to 7,000 feet at Denver. It has a capacity of 100,000,000 cubic feet of gas per day, and needed 81,000 tons of pipe for its building. To supply these Colorado cities 350,000 acres of gas lands were secured, on which are 28 wells at present producing, with an open flow capacity of 625,000,000 cubic feet per day. Other wells have been drilled, but are now shut off.

Although this pipe line terminates in the heart of the Colorado coal producing region, enough industrial contracts were secured before the line was built to assure its success, including one with a steel company which itself mines one-third of the coal of the state.

Another notable gas line extends 430 miles from the great Louisiana gas fields to St. Louis, Missouri. It also is of twenty-two inch diameter. The material for its construction weighed 115,000 tons and required 4,435 freight cars to transport it to the scene of operations. The pipe line will

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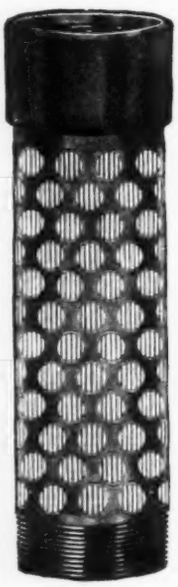

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carry 100,000,000 cubic feet of gas per day at an initial pressure of 350 pounds.

Birmingham, Alabama, and Atlanta, Georgia, are now reached by a 450-mile gas line from Louisiana. A line nearly 400 miles in length, able to handle a peak load of 250,000,000 cubic feet per day, serves Kansas City. Salt Lake City, Utah; Cincinnati, Ohio; Cleveland, Ohio; Buffalo, New York; Louisville, Kentucky; New Orleans, Louisiana; Los Angeles and San Francisco, California; Pittsburgh, Pennsylvania; are other of the great cities of the United States served by natural gas.

A number of old oil pipe lines were recently purchased by a gas company for the purpose of supplying Philadelphia with natural gas, and a proposal is being considered to supply New York City with this fuel.

In California natural gas is rapidly eliminating manufactured gas. More than 5,000 miles of natural gas pipe line has been laid in that state alone in the last ten years, and at present a single company has 700 miles of gas pipe line planned and under construction. When this is completed, 98 per cent of the gas consumption in California will be natural gas.

Over 1,600 miles of gas pipe line radiate from the gas fields of the Texas Panhandle, and plans are under consideration for a gas line from that region to Chicago, a distance of 1,000 miles. The laying of a Texas line is pictured in Figure 2.

The construction of these pipe lines required not only large amounts of capital, supplied because of faith in the future supply of natural gas, but also engineering skill of highest order. Developments in pipe manufacture, producing pipe of high tensile strength, new pipe laying machinery, and advances in welding practice so that in many cases welding could be done automatically, have greatly contributed to the success of these projects. Aerial photography has assisted in the selection of rights-of-way and the planning of operations.

In Figure 4 is shown a pipe line laid in Montana with the temperature 10 degrees F. below zero. The traversing of a rough and arid region is shown in Figure 5. The laying and coating of a pipe line to avoid its corrosion is represented in Figure 6. In Figure 7 a single line is being laid across a river, while in Figure 8 the pipe has been divided in crossing a bay so that an accident to one pipe would not interrupt service. This pipe was later lowered to 45 feet below the surface of the water.

### *Industrial Use of Natural Gas*

Approximately eighty per cent of the natural gas produced in the United States is put to industrial use, while the remainder fills domestic needs. The largest consumers of gas are the producers of oil, who operate with gas engines for drilling and pumping and compressors for recovering natural gasoline. Petroleum refining, generation of electricity and carbon black manufacture also account for large amounts of gas, as is shown in the table below:

CONSUMPTION OF NATURAL GAS IN 1928[1]

| | Cubic Feet | Cubic Feet |
|---|---|---|
| Domestic use | | 320,877,000,000 |
| Industrial use | | |
| Oil field use | 573,698,000,000 | |
| Carbon black | 175,137,000,000 | |
| Petroleum refining | 114,950,000,000 | |
| Electric plants | 77,326,408,000 | |
| Other industrial uses | 305,990,592,000 | |
| Total industrial | | 1,247,102,000,000 |
| Total consumption | | 1,567,979,000,000 |

[1] Bulletin, U. S. Department of Commerce, September 24, 1929.

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The use of natural gas for industrial purposes was nine per cent greater in 1928 than 1927, and a ten per cent increase is estimated for 1929 over 1928.

The superiority of natural gas and also of gas from the cracking process and from crude oil distillation over other commercial gases for heating purposes is evident from the table of calorific value below:

CALORIFIC VALUES OF COMMERCIAL GASES

| Gas | B. T. U. per cubic foot |
|---|---|
| Gas from the cracking process | 1250 |
| Natural gas | 1000 |
| Crude oil distillation gas | 1000 |
| Carburetted water gas | 550 |
| Coke oven gas | 500 |
| Water gas | 300 |
| Producer gas | 140 |
| Blast furnace gas | 100 |

In the generation of electric power the use of natural gas is showing a particularly notable increase. Whereas in 1919 but 2.4 per cent of the fuel used by electric power stations was natural gas, in 1928 it amounted to 7.2 per cent. The proportions of coal, oil and natural gas used in the generation of electricity in late years are shown in the table following:

FUELS USED IN PRODUCTION OF ELECTRIC POWER IN THE UNITED STATES, 1919-1928

| Year | Per Cent of Total Fuel Used | | |
|---|---|---|---|
| | Coal | Oil | Natural Gas |
| 1919 | 90.9 | 6.7 | 2.4 |
| 1920 | 90.0 | 7.4 | 2.6 |
| 1921 | 89.2 | 7.9 | 2.9 |
| 1922 | 88.9 | 8.0 | 3.1 |
| 1923 | 89.1 | 7.8 | 3.1 |
| 1924 | 86.3 | 8.9 | 4.8 |
| 1925 | 90.1 | 5.4 | 4.5 |
| 1926 | 90.2 | 4.8 | 5.6 |
| 1927 | 90.7 | 3.4 | 5.9 |
| 1928 | 89.2 | 3.6 | 7.2 |

Because during this period there was an increase in the amount of power generated, the gain in the use of natural gas was even larger than the table would indicate, amounting to 361 per cent, against a 12 per cent gain for coal. In four southern states, where the greatest increase in the use of natural gas occurred, 17,255,490,000 cubic feet of natural gas were consumed in 1924 and 50,305,878,000 in 1928. In California a single electric power generating plant utilized 12,000,000,000 cubic feet of gas in the first ten months of 1929.

### *Gas Engines*

A major use of natural gas is the operation of internal combustion engines. In the oil fields these engines are used to operate drilling machinery, well pumps, pumps actuating gathering systems, compressors in gas and air lift installations, compressors in natural gasoline recovery plants, and electric generators. The engines are of a variety of sizes and types, single or multiple cylinder, high or low speed. They may be of as great capacity as 3,000 horsepower, while 1,000 horsepower engines are extensively used. Gas engines are preferred to steam boilers in the oil regions because gas is almost always at hand, less skilled labor is needed with gas, and there is no loss of power in transmission. A view of a large compressor station in Texas is shown in Figure 9. Gas engines are easily portable. When a new well comes in it is often possible to rush a gas engine to the spot and pump to the gathering system flush oil that could not be handled economically in any other way.

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In long gas pipe lines it is necessary to place compressor or "booster" stations along the line to accelerate the flow of gas. The pumps in these stations are normally driven by gas engines. Oil pipe lines also require pumping stations at frequent intervals. Where gas is available, oil lines are often equipped with gas engines.

### *Fueling Graf Zeppelin*

The approximate consumption of fuel gases during the round-the-world flight of the Graf Zeppelin[1] was as follows:

| | |
|---|---|
| Pyrofax | 975,000 cubic feet |
| Ethane | 850,000 cubic feet |
| Blau gas | 850,000 cubic feet |
| Natural gas | 325,000 cubic feet |
| Hydrogen | 215,000 cubic feet |
| Total | 3,215,000 cubic feet |

### *Helium From Natural Gas*

The story of helium is a romance of modern industry. First discovered in the sun, in 1868, and in 1894, in the gases given off by a rare mineral, it was a scientific curiosity until the great war. At the pre-war value of helium a quantity sufficient to fill an airship, if that quantity could have been obtained, would have cost three billion dollars.

In 1907 Cady and McFarland made the momentous discovery that helium was present in the natural gas of Dexter, Kansas. During the war great interest in helium was aroused and plans for its isolation from natural gas were made which were carried to completion after the war. It is now known that much of the natural gas in the United States contains helium, at least in traces. The maximum that has been reported by the government is slightly over two per cent, while a single well with 7.8 per cent helium has been claimed by a private firm. Helium can be commercially extracted if present in natural gas to the extent of one-half of one per cent. A single gas field in Texas is estimated to contain enough helium to fill 100 dirigibles of the size of the Graf Zeppelin and keep them afloat for five years. In case of necessity 100,000,000 cubic feet of helium per year could be produced in the United States.

A plant with a capacity of 1,000,000 cubic feet of helium per month was erected by the federal government at Fort Worth, Texas, shortly after the war. This plant produced over 43,000,000 cubic feet of the gas. Because of the depletion of natural gas fields near Fort Worth, a second plant, much improved in design, has now been built and put in operation at Soney, near Amarillo, Texas. In July, 1929, the production of helium there was 648,850 cubic feet,[2] at a cost of about $20 per 1,000 cubic feet. Compare this with the cost of $500 per 1,000 cubic feet in the war-time experimental plants. Production of helium by private companies is also commencing.

Helium of 93-94 per cent purity is obtained by liquefying all the other constituents of natural gas at temperatures running down to that of liquid nitrogen, under a pressure of 1,000 pounds per square inch.

### *Domestic Use*

In 1928, as shown by a table already given, 320,877,000,000 cubic feet of natural gas was supplied to 4,365,000 domestic consumers in over 2,000 communities in the United States. This was an increase over 1927 of ten per cent in the number of consumers and eight per cent in the amount of gas used. The value of this gas at points of consumption was $225,000,000.

At times natural gas is pumped directly into city gas mains. In other cases it is used to enrich manufactured gas, such as producer gas or water gas, as the natural gas has a calorific value far above these. This use is increasing. In 1929 about 75,000,000,000 cubic feet of natural gas was purchased for use with manufactured gas, a gain over the previous year of fifty per cent.

A thermal analysis of the reforming process is given below:

HEAT BALANCE IN REFORMING NATURAL GAS

| | |
|---|---|
| "Fuel" gas per 1,000 cubic feet reformed gas, cu. ft. | 190.3 |
| "Make" gas per 1,000 cubic feet reformed gas, cu. ft. | 556.1 |
| | 746.4 |
| Expansion of "make" gas | 1.798 |
| Expansion of "fuel" and "make" gas together | 1.340 |
| Calorific value Natural gas | 1186 |
| Calorific value Reformed gas | 602 |
| Calorific value total "fuel" gas used, in million B. t. u. | 3200 |
| Calorific value total "make" gas, in million B. t. u. | 9360 |
| | 12560 |
| Calorific value reformed gas, in million B. t. u. | 8540 |
| Thermal efficiency, on "make" gas alone, per cent | 91.2 |
| Thermal efficiency, on total gas used, per cent | 68.0 |

("Fuel" gas is used to heat up the generator; "make" gas is that actually reformed.)

Hough and McLaughlin[1] found that in some cases adding air to the gas being reformed was an advantage, as its combustion increased plant capacity and in some cases thermal efficiency. The use of air increased the density of the finished gas, however, and this limited the extent to which air could be added. Yunker[2] at Louisville, Kentucky, faced the same problem of preparing from natural gas a domestic fuel which could be substituted for mixed gas. He passed natural gas through a water gas generator in which the coke had been blasted to above the decomposition temperature of methane. An expansion of the gas of 2.25 to 1 was obtained, with consumption of fifteen pounds of coke per 1,000 cubic feet of natural gas.

Natural gas is also prepared for city use by subjecting it to a process of partial combustion, which increases the volume and decreases the calorific value.

The major use of domestic gas is for heating purposes. Recent years have seen the shifting of the lighting load from gas, either manufactured or natural, to electricity. Foremost among heating uses of gas is cooking, but house heating by gas is growing rapidly because of its convenience, and suitability for automatic regulation. An increase of 50 per cent in this use is reported in 1929. Refrigeration, water heating and household incineration are also important. Cooling buildings in summer by gas refrigeration is being considered in the United States.

### *Bottled Gas*

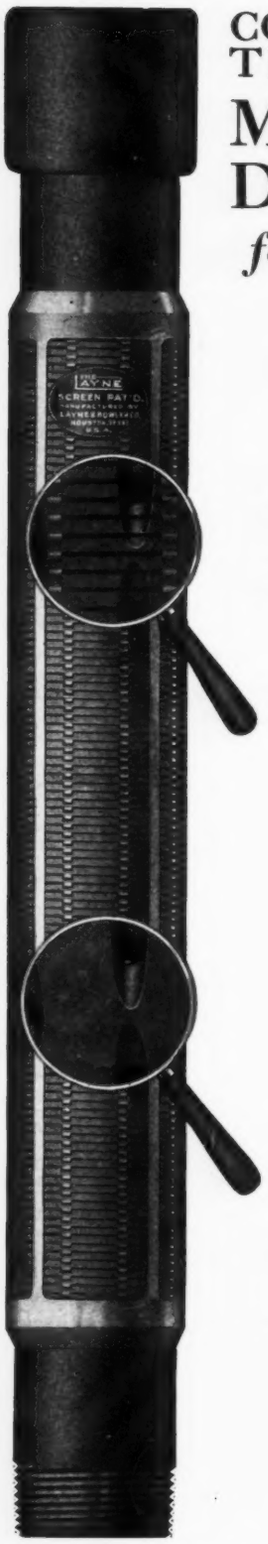
A new development in the utilization of natural gas is the sale of "bottled" gas. This is liquefied propane and butane. These substances are undesirable in natural gasoline in more than limited amount, and may easily be fractionated from this gasoline when it is stabilized. An earlier table showed that tremendous amounts of these two hydrocarbons are available. It has been estimated that the propane and butane that could be obtained has twice the calorific value of all the manufactured gas produced in the United States.

Although this bottled gas is a relatively new product, it has found many uses, and its consumption is growing rapidly.

[1] J. G. Davidson, Carbide and Chemical Corp.
[2] Oil Gas J., Aug. 29, 1929, 82.

[1] Proc. Pac. Coast Gas Assn. 16, 511 (1925).
[2] Oil Gas J., 27, No. 51, 111 (1929).

# New Plant



COSTING MORE THAN A HALF MILLION DOLLARS *for* THE LAYNE *Milled Groove Screen*

**From an humble beginning, but through ingenuity and a profound knowledge of fundamentals in separating oil from slush, the Layne & Bowler Company have grown to be one of oil industry's most important manufacturers, with its great modern plant costing more than a half million dollars.**

**When the Lucas Gusher was running wild at Spindletop in 1901, M. E. Layne, then located at Rock Rapids, in Northwestern Iowa, in the business of drilling water wells, made a trip to Beaumont, Texas, to investigate conditions. The conditions found were so very similar to the conditions under which Mr. Layne had been successful in obtaining water in the North, that he believed the oil sands could be handled even with the heavy gas pressure, if the proper screen were set in the oil wells.**

**In January, 1904, Layne & Woodburn formed a partnership to manufacture the Keystone Wire Wrapped Screen, under Mr. Layne's patent. The screen proved so successful that in a short time a larger shop was needed, and the sale of the screen was handled by the partnership firm of Layne & Bowler, composed of M. E. Layne and P. D. Bowler. In 1907 the Layne & Bowler Company was incorporated, taking over the partnership of Layne & Woodburn and Layne and Bowler Company.**

**The Layne & Bowler Company has very materially helped to develop the Coastal Oil Fields, and the product, so successful, has become universally used throughout the oil fields of the world.**

**And the "Greater Production" Layne Milled Groove Screen is the culmination of more than a quarter century's development, now the oil industry's latest, greatest, and most important invention, being manufactured at Houston, Texas, in the great new plant, costing more than half a million dollars, which stands as a symbol of achievement.**

## The Layne & Bowler Co.

**HOUSTON, TEXAS**

**The Layne New York Co.** 30 Church St., New York
**The Layne & Bowler Corp.** Los Angeles, Cal.
**Vickers, Limited** London, England


# Use of Engine Cards for Determining Ignition Accuracy

THE value of periodical checks with engine cards to determine the accuracy of ignition is revealed in the accompanying card reproductions. Unless ignition troubles are found and corrected quickly they will often lead to unnecessary and expensive repairs. At the same time the engine is losing some of its efficiency while operating at a higher cost.

Premature ignition is probably the most serious of the troubles because of the impossibility of proper cylinder lubrication and undue loads and strains on the bearings. Figure 1 is a card from a cylinder in which premature ignition has taken place. Such a card as this may be due to the spark being advanced too far, excessive temperature within the cylinder, or to early ignition resulting from conditions on the opposite side of the piston. (The last mentioned possibility, of course, holds true only in double acting engines, and then only when the piston rings are in very bad condition.) Aside from the damage being done to the engine because of high initial pressure and the impossibility of proper cylinder lubrication, in many cases the power developed by the cylinder may not be but little above that required to compress the explosive mixture.

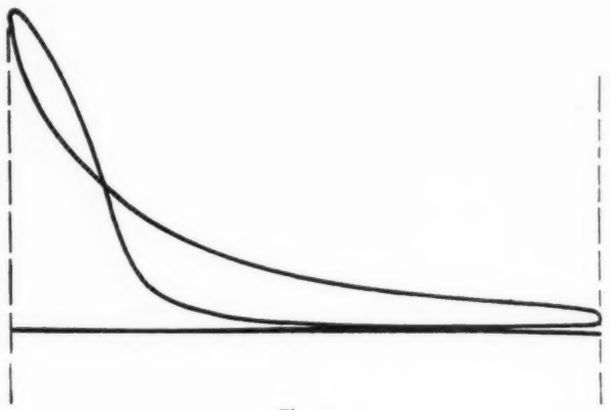


Fig. 1

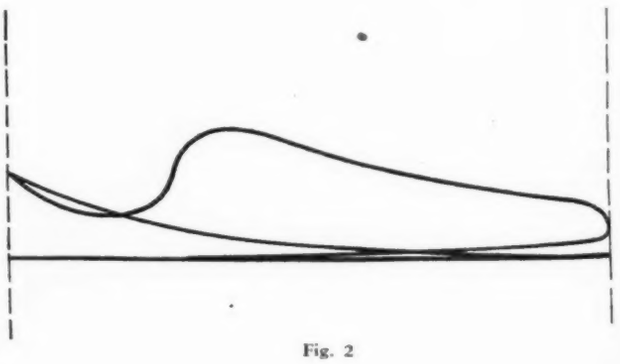


Fig. 2

In such extreme cases as this it is wiser to stop ignition entirely and shut off fuel where this is possible. This procedure will at least eliminate the hazard of serious damage

to the engine, even though some power may be sacrificed.

An example of an extreme case of late ignition is represented in Figure 2. While it is an extreme case it is a condition that might easily exist. It is evident that firing does not take place until the piston has traveled almost a quarter of a power stroke. Obviously, a very high pressure will prevail at the opening of the exhaust valve, and the horse power developed will be materially reduced.

This defect produces practically the same condition within the cylinders as too rich a mixture. Too rich of an air-gas mixture is harmful to the engine because of the high pressure, and, consequently, high temperature at exhaust which subjects the exhaust valve to excessive heating. In addition, the horse power developed is much less even though the fuel consumption does not decrease. Either condition is of sufficient importance to necessitate immediate relief, but the high temperature of the exhaust is the more vital of the two. Unless the exhaust valve is seating properly it is a matter of only a short time until repairs will be necessary.

A card in which ignition occurs too early, but where all other conditions are ideal, is represented in Figure 3. The advanced ignition causes the initial pressure during the power stroke to reach an extremely high valve, while no gain in power is realized.

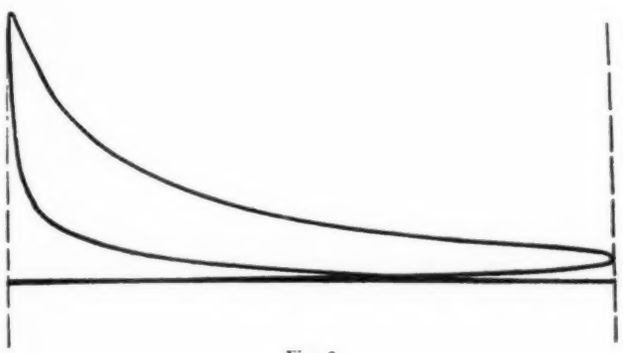


Fig. 3

This condition is detrimental to the engine as it places undue loads and strains on the bearings and other parts, and should not be permitted to exist under any circumstances. Ignition advanced too much is usually revealed by the engine "bumping" under heavy loads. It will be noted that the line representing the burning of the air-gas mixture is almost vertical in this case.

In all cases ignition of the engines should be carefully watched and any trouble developing from this source should be corrected before serious damage is done to power equipment.

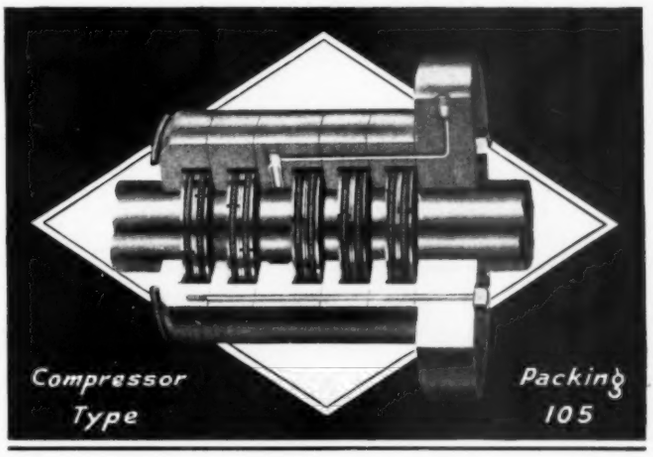
## Equitable Gas to Drill Fifty Wells

PLANS have been completed by the Equitable Gas Company for expending $400,000 during the summer months in the drilling of new wells and the laying of pipe lines in southwestern Pennsylvania and West Virginia in order to meet demands for natural gas for the winter season.

Fifty wells are to be drilled, chiefly by the Pittsburgh & West Virginia Gas Company, a subsidiary, while work will soon start on the laying of a pipe line through central West Virginia at a cost of $170,000.

COOK'S GRAPHITIC IRON ROD PACKING

FLOATS WITH THE ROD




ELIMINATING THE THIRD BEARING

IN a reciprocating unit the angular thrust of the connecting rod is absorbed by the crosshead bearing. The cylinder acts as a bearing in carrying the Piston. These two bearings must be kept in perfect alignment else the interposed packing will act as a *third* bearing on the rod.

Perfect alignment is disturbed by wear, unequal expansion, faulty adjustment and vibration, any one of which causes a non-floating packing to act as a bearing. As this condition develops, friction increases, rod and packing wear is accentuated, and the packing leaks.

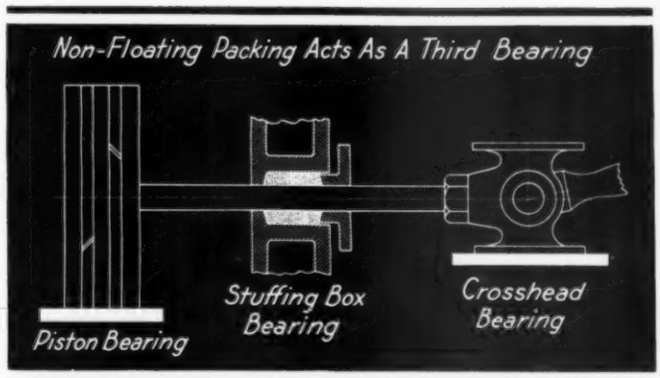
This trouble is completely eliminated in COOK'S Floating Metallic Packing as its design allows the packing rings to float with the rod. There is an approved type for all Air, Gas and Steam conditions.

Then, too, the wearing rings are made of Graphitic Iron, an exclusive material that aids in eliminating friction, and provides added years of service.

These exclusive features are being appreciated more and more as evidenced by the ever increasing use of COOK'S Packing by the leading operators in the oil and gas fields.

*Ask for Catalog No. 129*

*"Sealing Pressures Since 1888"*




C. LEE COOK MANUFACTURING CO.
INCORPORATED
LOUISVILLE, KY.
TULSA NEW YORK LOS ANGELES
*Agents in Principal Cities*

The trend toward more permanent and better finished buildings owned by exhibitors on the Exposition grounds is indicated in the structure shown here, which is to house the displays of the General Motors Corporation. General Manager Way, of the International Petroleum Exposition, is here checking the sidewalks with his plans to give all "outside" exhibitors concrete walks.

# New Buildings Completed For Seventh International Petroleum Exposition

THE ideal of a university completely divorced from all considerations of politics, geographical jealousies and suspicions and the observance of narrow policies, will be realized in the seventh International Petroleum Exposition and Congress, Tulsa, Okla., October 4-11.

This is the opinion of Congress, which passed a resolution to invite high governmental officials of the states and representatives of foreign nations to attend this "World's Fair of the Oil Industry," and of President Hoover, who signed the bill carrying the resolution.

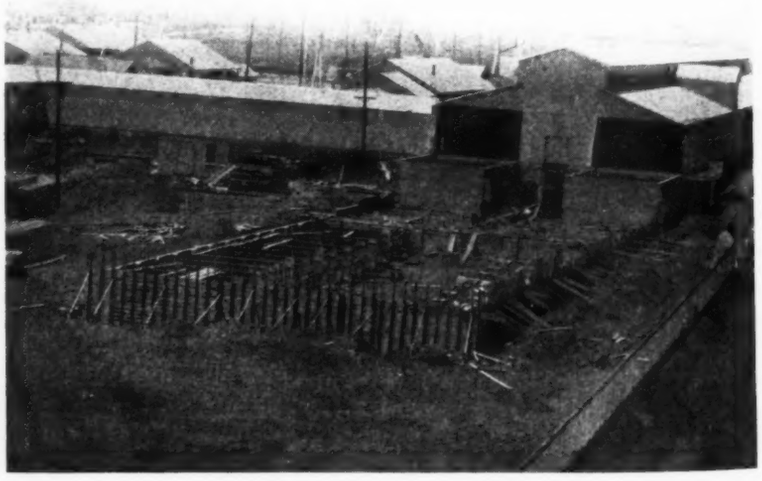
Such is also the opinion of officials of the American Petroleum Institute, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, petroleum division; the United States Bureau of Mines, petroleum division; American Gas Association, natural gas department, and of other influential groups, all of which are taking an active part in the oil show's program.

As a marketing center the Exposition will carry a stock valued at between $8,000,000 and $10,000,000. As a representative fair of the petroleum industry the oil show will present all of the important elements which make up the producing, transportation, refining, natural gasoline manufacturing, marketing and utilization aspects of the industry.

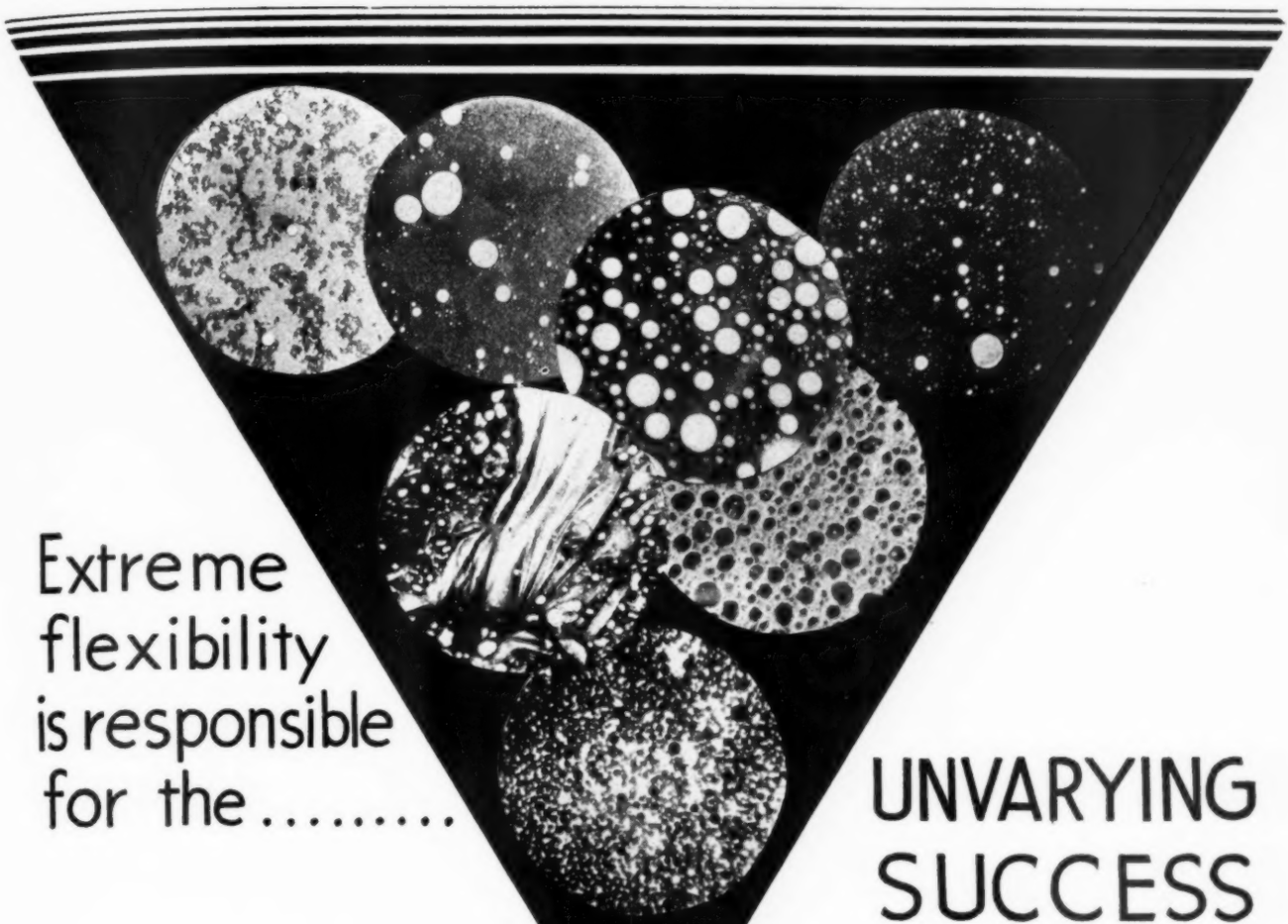
The university concept of the exposition is made up by hundreds of subjects that do not strike the eye as forcefully as the numerous towering steel derricks, the mammoth engines and the fascinating miniatures of refineries, natural gasoline plants, air and gas lifts and the like in operation.

Everywhere may be seen the results of scientific studies, but never so clearly and emphatically as in the scientific and technical building. It is in this large structure that the marvelous ingenuity of man is brought to the attention of visitors. The committee in charge of displays in this building is interested in the latest developments of the laboratories and is expected soon to make important announcements.

Of particular interest is the work being carried out at the oil show grounds by the American Society of Mechanical Engineers, petroleum division. One of the unusual feeatures on exhibition will be the automatic valve gates which are arranged in the $90,000 automatic pump station exhibit of the society. In controlling the fluid level in storage tanks, all elements of human error have been re-



Bird's-eye view of construction work, California building. This view shows how rapidly work is progressing on the California building at the exposition. The cement and concrete work will be ready for the steel superstructure within a week. This building and that of the Marketers and Refiners are the finest on the grounds. Both are 240 feet long and 60 feet wide, all steel, and provided with the latest steel-glass lighting and ventilating system. The wood floors are over a concrete base.



# Extreme flexibility is responsible for the..... UNVARYING SUCCESS *of the* — PETRECO PROCESS

A GLANCE at the various types of crude oil emulsions illustrated here quickly discloses why any method or process of treatment must be extremely flexible in the application of basic principles involved, in order to record such uniform and eminently successful results as the Petreco Process has achieved over a period of almost twenty years.

Of the thousands of crude oil emulsions encountered throughout the different oil fields, no two are alike in character, in percentage and degree of emulsification, gravity, small particle size, component parts of water and emulsion, colloidal content, amount of sediment, tenacity of the emulsifying film, et cetera. Some emulsions are "tight", others are "loose"; some are the oil-in-water type, some are the water-in-oil type, and others contain both types. Even the slightest variation in any one of these may require some change in the application of one or more of the principles involved in the method of treatment, in order to prove successful and efficient.

The Petreco Process is extremely flexible in operation. While the application of basic principles involved has given efficient and satisfactory results, it can be varied over a wide range, and also permits of the use or elimination of auxiliaries and combinations which Petreco engineers and technicians have developed to successfully cope with the variations encountered in the emulsions.

The use of Petreco assures the successful solution of "cut oil" problems—not fairly successful nor successful to an average degree, but eminently so. Get the complete story of Petreco in our Bulletin No. 30-3.

***Fully covered by process and apparatus patents.***

**PETROLEUM RECTIFYING COMPANY of CALIFORNIA**

Security Title Insurance Bldg. 530 West 6th Street, Los Angeles, Calif.

Petroleum Bldg., Houston, Texas

*When writing* PETROLEUM RECTIFYING CO. *please mention The Petroleum Engineer*

duced to a minimum. Automatic correction is made for breaks in feed or suction lines, for dangerous vapor conditions about the control station, for high temperature, and the electrical circuits respond smoothly when abnormal loads are demanded.

In demonstrating the feasibility of controlling a tank farm from some remote point, a control board will be operated from a room in a downtown hotel. The liquid level in the tanks is ascertainable from the remote control point.

While it is commonplace to expect many innovations and novel ideas at the exposition, probably the greatest changes will be noted in the oil show plant itself.

The expansion program carried out this year adds at least five new buildings to the plant, and greatly improves the grounds, at a cost of approximately $200,000. The largest International Petroleum Exposition and Congress this October will represent the execution of plans long cherished by the officials and only made possible this year.

One of the new buildings is the Marketers and Refiners building, just completed. An exact duplicate of this structure is now under construction and will be known as the California building. The bird's-eye view shows workmen finishing the concrete foundation, basement and ramp of the California building.

The Marketers and Refiners building marks the departure of the exposition from the position of a "producers' show." A committee is also at work in this new department so that not only will the products and equipment of refining and marketing be shown, but also the problems most agitated in these branches of the industry. Arrangements are being made for the airing of views and expression of complaints and suggestions.

The California building means more to the exposition officials than the mere addition of numerous booths for exhibitors. This structure is material and undeniable proof of the feelings of friendship and recognition which men of the Mid-Continent hold for those of the California fields.

An outstanding feature of the 1930 oil show will be an open forum on the problems in the petroleum industry. Because the exposition is unrestricted by the necessary observance of such policies as characterize the various associations which promote the interests of the oil industry, the oil show is free to give a voice to all conflicting ideas, from the most conservative and reactionary to the most radical and revolutionary.

The congress aspect of the exposition presents the views of foreign nations. Through diplomatic channels the department of state invites delegates from at least fifty-two overseas countries, Canada, Mexico, and South American nations. Following the congress the foreign representatives may view the oil show as a vast and dynamic catalog from which they may select their requirements.

The Railway Express Company and the American Line (steamships) have placed their foreign offices at the disposal of the exposition for publicity purposes and are giving invaluable service in distributing information about the oil show.

The railroads follow the custom of giving reduced fares to Tulsa for the exposition. Tickets purchased under the reduced fare classification are validated only at the oil show grounds. In Tulsa all of the hotel and apartment house proprietors coöperate with the exposition to give accommodations to visitors.

To return now to improvements which have been made at the exposition grounds: Nearly 3,000 lineal feet of sidewalks have been laid, giving all outside exhibitors a concrete walk; the number of drain basins has been raised from six to twenty, assuring speedy drying of grounds in case of rain; two separate septic tank installations have been added, as well as six fire plugs.

# "Made properly for pipe line construction

**particularly for ditching in rough country where the surface is cut up with washes."**

**That, according to the statement of a Mid-Continent contractor, is why he chose six Buckeye pipe line ditchers in preference to others.**

**Detailing their service, he states that they are used for "general pipe line trenching. Soils vary from light, sandy loam to extra hard gumbo and loose rock formation. We have ditched through some very rough country, that looked impossible to get a machine over.**

**"Our best day was made during December, 1929, near Clay Center, Kansas. Our machine cut 6875 feet of 24-inch by 54-inch ditch in 10 hours. However, we have several days that exceeded 1 mile in 10 hours. During January, 1930, one machine cut 8100 feet of 24-inch by 36-inch ditch in 9 hours, with 8 inches of frost in the ground."**

**Like most Buckeye owners, this contractor uses them exclusively—Ditchers, *Service* Backfillers and *Utility* Backfiller-Cranes. It is just one more instance of a capable organization and dependable equipment forming a profitable, winning combination.**

**Write for our new catalog, "Buckeye—*The* Pipe Liner." It gives complete specifications, pictures these popular ditchers in action and gives dependable performance data.**

## The Buckeye Traction Ditcher Co.

FINDLAY, OHIO

***There's a Buckeye Sales and Service Office near You***

*for over thirty years* Buckeye

## Front Cover Picture

THIS month's front cover shows the General Petroleum Corporation's natural gasoline plant at Santa Fe Springs, Calif. The plant consists of a battery of nine six-foot diameter bubble type absorbers. There are five distillation units, two of which were built in 1923 and three in 1929. The stabilizer was also built in 1929. There are five large cooling towers in the plant, three of which accommodate open type coolers and condensers for the new distillation unit. The peak load of this plant, which is now slightly reduced on account of curtailment of production, was 170,000,000 cubic feet of gas, which yielded 180,000 gallons of gasoline daily, the largest production of any natural gasoline plant in the world. It was built by C. F. Braun & Co., Ltd., at Alhambra, Calif.

## Death of A. C. Picard

THE passing of Albert C. Picard on June 17 at his home in Detroit occasioned the deepest regret among his many friends in the oil industry. Pic, as he was familiarly known, had been for many years active in the development of modern lubrication, particularly that pertaining to gas and oil engines, and his death constitutes a distinct loss to the industry.

He had been general manager of the lubricator division of the McCord Radiator & Mfg. Co., Detroit, for some eighteen years, and during that time this department of the McCord company had become one of its most important units. A member of the American Society of Mechanical

A. C. Picard

Engineers, he was always active in any development that had to do with mechanical lubrication, and contributed in no small measure to its wide use in the oil field. Born in Detroit, his business life was almost entirely devoted to the development and merchandising of lubricating apparatus. He was always a popular and prominent attendant at the various conventions and exhibitions of the oil industry and was known for his genial smile and disposition. He died very suddenly while asleep, having left his office the night before in apparent good health.


# Electric Power

## offers greater *traffic ability* *in* OIL TRANSPORTATION

**The more traffic a pipe line handles, the greater its earnings per dollar of investment. The electric motor has demonstrated, time after time, a greater traffic ability than any power.**

**Electric power for pumping and booster stations is an accomplished, practical fact, that is producing substantial results in economical and efficient operation.**

**Our Commercial Engineers will gladly submit interesting and enlightening data concerning the installation and operating economies made possible by Electric Power.**

**EASTERN OKLAHOMA is served by PUBLIC SERVICE COMPANY of OKLAHOMA**

Public Service Company supplies ample, dependable electric power to 25 Counties in Eastern Oklahoma through more than 1,100 miles of transmission lines, from 5 large generating stations and 12 inter-connections with other systems.

**PUBLIC SERVICE COMPANY of Oklahoma**

PUBLIC SERVICE BUILDING . . TULSA

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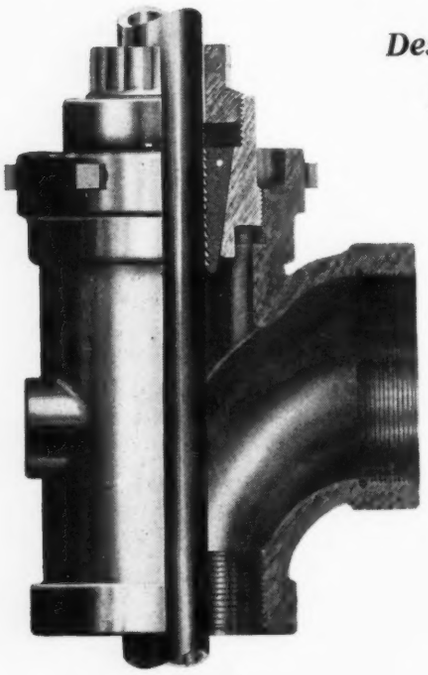
# *The* HERCULES FLOW HEAD



*Designed for*

## Air *or* Gas Lift

**Type A**
**HERCULES FLOW HEAD**
(*Patent Pending*)

**The Hercules Flow Head is made with a 90° "T" or "Y" type body—designed with an upward curved outlet that eliminates friction. Also made with thirty degrees and forty-five degrees side outlet.**

**The top section, or flow head packing bowl, screws down into the top of the body. The packing bowl is equipped with three slips which support the tubing by gripping completely around it. There is a rubber packing ring on top of the slips which is compressed by a packing nut that screws down into the packing bowl and packs off around the tubing. This is the only packing used and can be replaced without disconnecting the well.**

**The body of the Flow Head is equipped with a regular casing-head top and set screws, so if it is desired to run tools into the well an oil saver can be used. This is accomplished by unscrewing the top section and removing same from the flow-head body.**

**The inside diameter of the body is the same size as the outside diameter of the casing on which it is made up.**

**The body is made of electric steel casting and the top section or packing bowl is made of forged steel, making the Flow Head an exceptionally strong and serviceable device. It will hold a pressure of 3,000 pounds and carry a hanging weight of over three hundred thousand pounds. It is very simple and compact and is adaptable to all wells.**

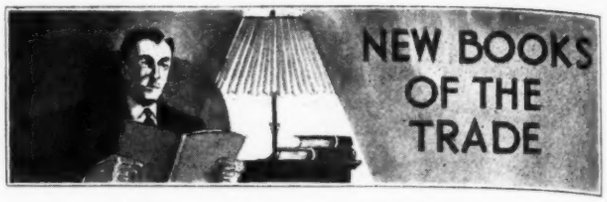
***Made for all standard size regular and A. P. I. casing.***

***For additional information write for a catalogue.***
***For sale by all leading supply houses.***

**HERCULES TOOL COMPANY**
**OIL WELL SPECIALTIES**
*Tulsa Oklahoma*

**P. O. Box 286 Phone 3-2358**

**Export Agents**
**AMERICAN STEEL EXPORT COMPANY**
**295 Madison Avenue, New York, N. Y., U. S. A.**
**Cable Address: "AMSTA"**


### *Olivite Acid Pumps Catalogue*

A NEW catalogue, No. 301, has been prepared by Oliver United Filters Incorporated, with offices in San Francisco, Chicago, New York and London. The bulletin describes the Olivite Acid Pumps.

The one and one-quarter-inch pump is an addition to the Olivite line. The pump may be used either with a motor drive or with a belt drive. There are several improvements to the two-inch pump. Details may be secured from the company.

### *Buckeye Wheel-Type Pipe Line Ditchers*

THE Buckeye Traction Ditcher Company, Findlay, Ohio, has just issued a very attractive and interesting catalog that describes and illustrates the Buckeye Wheel-Type Pipe Line Ditchers. In addition to the mechanical description of the machinery the booklet deals particularly with the services of the Buckeye in the oil and gas fields, and lists pipe line contractors using Buckeye ditchers.

### *Continental Equipment Catalog*

A NEW catalog has just been issued by the Continental Equipment Company featuring the Continental air and gas lift turbine pump, which is an improved flow device. Various methods of hook-up are illustrated. Other products described include the Continental slush pump piston, rods, valves and castro belt dressing. A copy may be procured by addressing the manufacturers in the Subway Terminal Bldg., Los Angeles.

### *Universal Mist Extractor*

THE Universal Mist Extractor is a device for removing entrained oil and water from natural and other gases and vapors, so that nothing but oil and water free gases and vapors are conveyed to the Natural Gasoline Plant, Fractionators, Compressors, etc.

A bulletin describing completing the purpose of separation for the natural gasoline manufacturer and the refiner and pipe line man has been issued by the Hydrocarbon Apparatus, Inc., 405 South Hill Street, Los Angeles. This bulletin also describes the mechanism of the extractor and its principles of operation.

Another bulletin from this company that has just come off the press is on Universal Valves of various types, such as the throttle valve; quick-closing valves; safety valves and float valve.

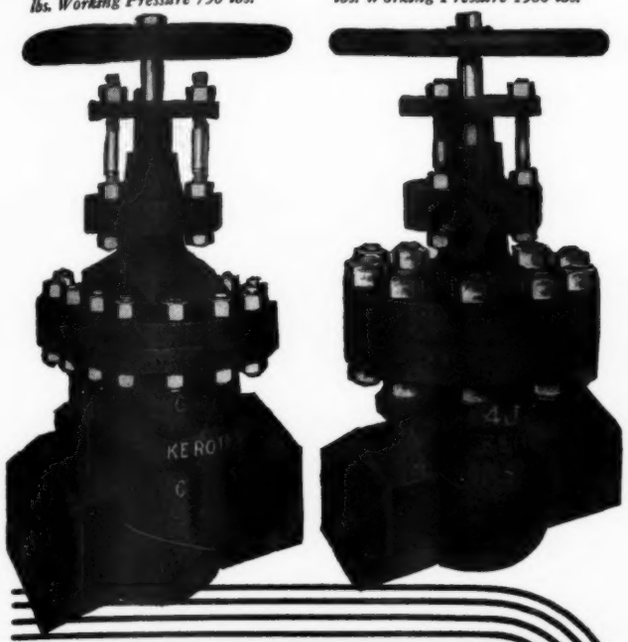
### *Water and Boiler Efficiency*

FEEDWATERS, INC., 40 Rector St., New York City, has published a 60-page booklet on water and boiler efficiency that is dedicated to the advancement of science and for the betterment of conditions in steam engineering. The booklet has tried to show simply and concisely the value to every steam user of efficient boiler feed water treatment, and the troubles likely to be caused by inattention.

Practically every phase of steam engineering has been discussed in nine chapters of the book and many interesting figures have been prepared. Water, scale, corrosion, colloidal condition, algor, water softening processes, features of interest, boiler plant auxiliaries, and boiler practice are titles of the various chapters.

**TYPE "H" FLOW LINE VALVES**
*All pipe sizes up to 8". Screwed or Flanged Ends. Test Pressure 1500 lbs. Working Pressure 750 lbs.*

**TYPE "J" FLOW LINE VALVES**
*All pipe sizes up to 8". Screwed or Flanged Ends. Test Pressure 3000 lbs. Working Pressure 1500 lbs.*



# FLOW LINE VALVES

**TYPE "K" FLOW LINE VALVES**
*All pipe sizes up to 8". Screwed or Flanged Ends. Test Pressure 2000 lbs. Working Pressure 1000 lbs.*

**TYPE "X" FLOW LINE VALVES**
*All pipe sizes up to 8". Screwed or Flanged Ends. Test Pressure 1000 lbs. Working Pressure 500 lbs.*

**TYPE "F" FLOW LINE VALVES**
*All pipe sizes up to 8", Screwed or Flanged Ends. Test Pressure 6000 lbs. Working Pressure 3000 lbs.*

**The fact that Kerotest Line Valves and Fittings have been adopted as standard equipment by many of the world's largest oil producers constitutes its own recommendation to you as a user of valves and fittings.**

**Whatever size, weight, type or dimension, you may require, there's a Kerotest valve or fitting to meet your most critical and exacting requirement.**

## KEROTEST MANUFACTURING COMPANY
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### *Champion All-Steel Rotary Hose Catalogue*

A CATALOGUE on all-steel hose has been published by Champion and Barber, Inc., 506 Subway Terminal Building, Los Angeles.

This new book of eight pages gives a thorough treatise on the history, manufacture, etc., of the Champion all-steel rotary hose. The book is illustrated throughout with photographs and drawings.

### *Butler Ready-Made Steel Buildings*

THE Butler Manufacturing Company, Kansas City and Minneapolis, has published a loose-leaf type catalog on its Ready-Made Steel buildings, especially on those adapted for oil industry use. The book is most well illustrated and very thorough in the field it covers.

### *Demolition Tool Pamphlet*

CHICAGO PNEUMATIC TOOL COMPANY, 6 East 44th St., New York City, has published bulletin 865, which describes and illustrates the CP Demolition tools and sheeting driver. Specifications, designs and principles are given along with other data. The instruments are used for tearing out concrete and brick foundations and walls, cutting asphalt pavement, removing slag from ladles and slag pockets, glass from furnaces and tapping blast furnaces, driving sheet piling, etc.

### *Protecting Cracking Vessels*

PROTECTING Cracking Vessels with Non-Metallic Linings by Jacque C. Morrell of the Research Laboratories of the Universal Oil Products Co., Chicago, is a progress report on adaptation of non-metallic linings to the protection from corrosion of reaction chambers, dephlegmators, and other refinery equipment. Copies of this booklet will be sent free upon request.

### *Shaffer Tool Works Booklet*

A COMPLETE listing of all the products manufactured by the Shaffer Tool Works, Brea, Calif., is concisely presented and illustrated in a new booklet being distributed by this company. All of the uses for the various equipment are explained.

PHYSICAL Properties of Diphenyl is an eight-page pamphlet issued by the Swann Chemical Company, Birmingham, Alabama. As a medium of indirect heat transfer, where low pressures and accurate control of high temperatures are desired, this compound has a wide range of application.

### *Making Lime Soap Greases*

THE Making of Lime Soap Greases, Discussion No. 1, Circular 63, is being distributed by Sowers Manufacturing Co., Buffalo, N. Y. This is the first of a series of discussions on the making of grease. It is a four-page illustrated pamphlet describing the method and equipment both in the open kettle and under pressure.

### *New Volume on Flow Principles*

PRINCIPLES and Practice of Flow Meter Engineering is issued by the Foxboro Co., Foxboro, Mass. Price, $2.00. This is a 247-page bound volume, pocket size, showing the theory, description and type of meter used for liquid and gas flow measurements. It also describes the method of installing and operating flow meters and is a very valuable handbook for all men engaged in the measurement of liquids and gases.

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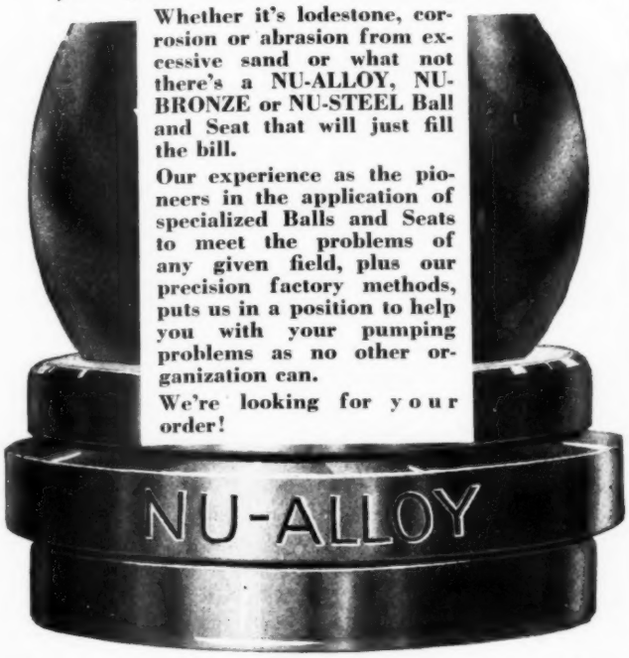


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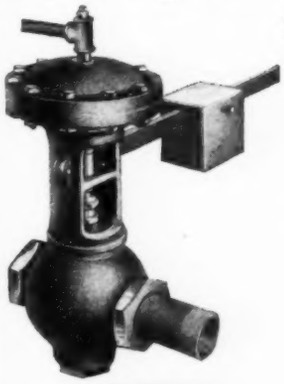

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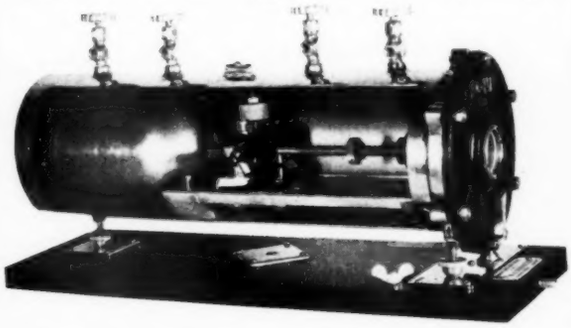

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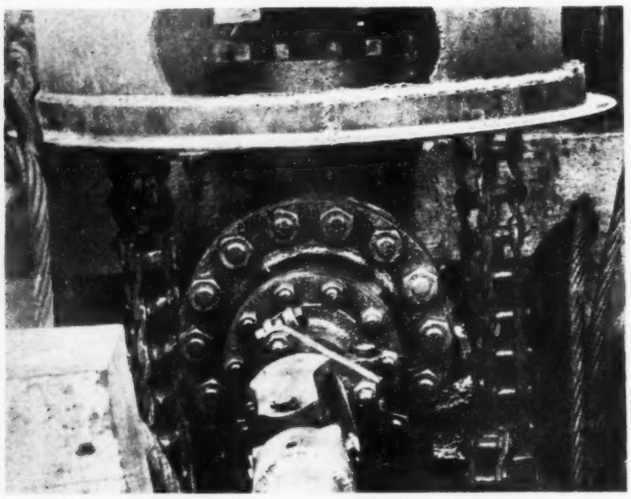
# Mud Trap *in* Unique Hook-Up *on* Well

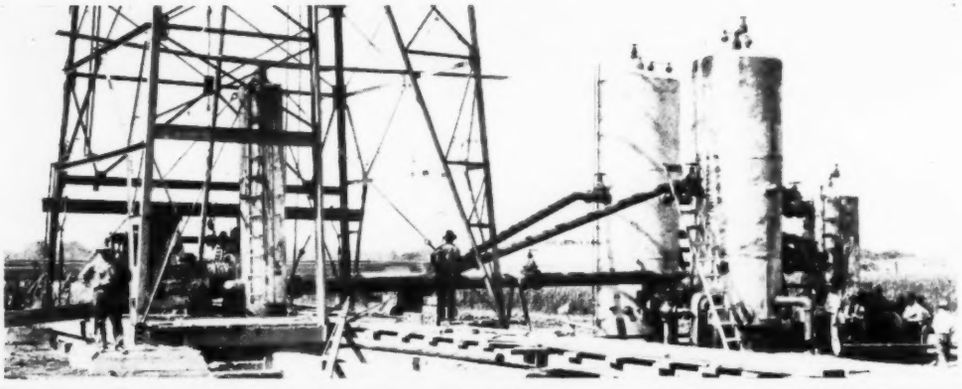


THE first attempt to separate rotary drilling mud from the oil and gas when completing a well in the Oklahoma City field was recently tried on T. B. Slick's Foote 1. The mud flowed out of the back side of the mud trap into dump pits, in place of the usual flow up the derrick and spraying a large amount of ground.

The hook-up on this well was quite elaborate. It employed a sand trap over the casing head, as used by a number of operators in the field. The flow line from this point extended toward the mud trap, passing between the two separators, which were between the derrick and mud trap. The main flow line continued to the mud trap, but a two-forked prong was made at a point between the derrick and separators, extending upwards at an angle to the separators. Part of the gas and oil, being lighter than the mud, separated at this point and went direct to the separator. The remainder stayed with the mud and was carried to the mud trap, where, after separating, was returned to the separators.

The diagram and pictures accompanying show more clearly the hook-up and direction of flow.

The mud trap is 5x15 size separator. The main feature of the mud trap is the heavy fluid valve made to draw off the heavy rotary mud.



**Top—Connections below sand trap over casinghead. At left—General view of installation.**

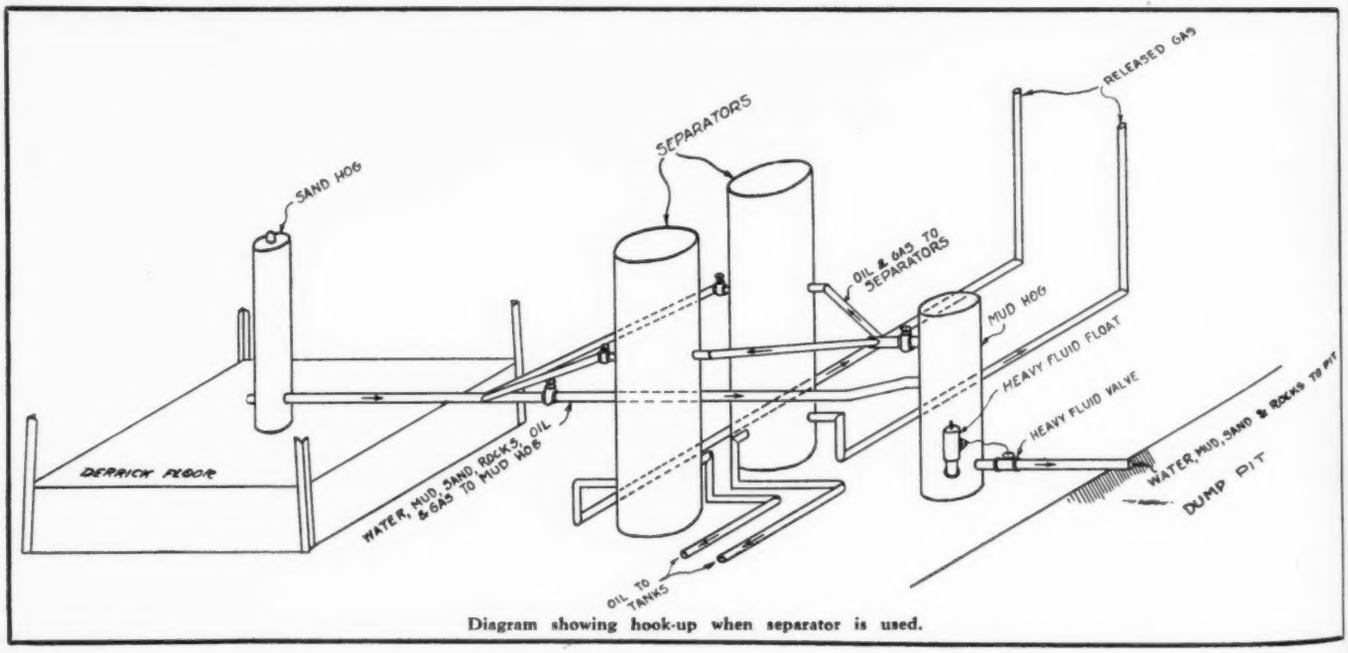
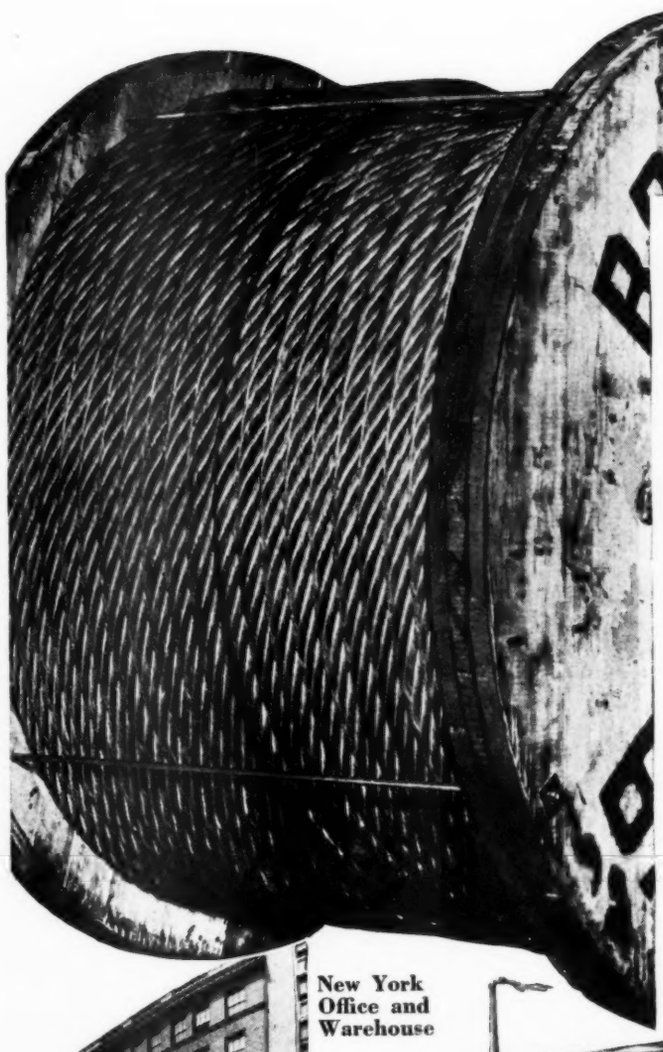



**Diagram showing hook-up when separator is used.**



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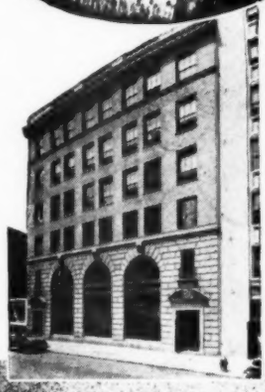

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## Contributing Causes of Crooked Holes

By A. T. Parsons

IT is popularly supposed that there are many different causes for a rotary hole going crooked. Actually, there is but one of any importance. The drill-stem was not vertical. There are many things that may make a drill-stem go off the vertical, but they will not result in a crooked hole if the drill-stem can be maintained in a vertical position.

The rigidity of a 2000-foot string of six-inch drill pipe fixed at the top and bottom of the hole only is equivalent to the rigidity of a ten-foot length of No. 24 copper wire. Similarly, the rigidity of an 8000-foot string of three-inch drill pipe is equivalent to the rigidity of a ten-foot length of No. 40 copper wire, the smallest size that is ordinarily drawn. No wonder it is hard to keep a hole from going crooked!

Sometimes a hole does not even start vertical, on account of a poorly-leveled rotary table or a poorly-aligned kelly.

Boulders and side-tracked "fish" of all kinds produce a temporary bending of the drill-stem. Sometimes it straightens somewhat after passing the obstruction. Probably more often it does not.

If the angle between the bit and the strata penetrated differs materially from a right angle, there will be a tendency for the hole to change direction. There is some disagreement as to the resulting direction of drift, but the consensus of opinion is that in passing from a soft to a hard and inclined stratum, if the bit makes a notably acute angle with the plane of dip the hole tends to drift down dip. If it strikes the hard layer at a notably obtuse angle the hole drifts up dip. Other geological features, such as an inclined fault plane, probably have a similar tendency.

A dull or a poorly-dressed bit will usually aggravate this tendency and may even start a hole going crooked when the strata are practically level.

Too much weight on the bit is probably the greatest single factor in causing the drill-stem to get off the vertical. In considering weight on bit we should probably specify weight per square inch of theoretical bearing surface on bottom of hole, rather than total weight as is usually the practice.

A heavy flow of thin circulating fluid may, in very soft formations, cause an irregular jetting action on the sides of the hole, causing the bit to drift in the direction of maximum removal of material.

On the other hand, thick mud may ball up in front of the bit and thus deflect it from the vertical.

Some of above causes are mechanical and within the control of the driller. Others, geological or otherwise, are outside his control. With these he can merely endeavor to minimize their probable bad effects. Frequent determinations during drilling of both inclination and direction will permit corrective measures before their cost becomes nearly if not quite prohibitive.

## Correction in Dresser Advertisement

IT has just been discovered that the photograph of a pipe line appearing in the S. R. Dresser Manufacturing Company advertisement which ran in the February issue of The Petroleum Engineer was incorrectly identified as being a part of the Amarillo-to-Denver 22-inch Dresser coupled high-pressure natural gas line. This advertisement was entitled "In the Higher Altitudes Dresser Couplings Dominate." Instead of a view of the Denver line, the installation shown was a view taken in Wyoming, showing a section of a line installed by the Midwest Refinery Company. The Dresser company's policy is to be accurate in every one of its printed advertising messages and for this reason the wrong identification of this particular photograph is being announced as promptly as possible.

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## Have You Any Interesting Oil Industry Pictures?

FOR use in the Pictorial Petroleum Section, The Petroleum Engineer desires unusual and interesting photographs. These may be of field scenes, new installations, new hook-ups, individuals, or any subjects likely to appeal to men in the petroleum industry. Especially do we want pictures of "old-timers" who are still active in the business and views with a foreign setting.

If you have such photographs, we shall appreciate your permitting us to reproduce them in our pictorial section. Extreme care will be exercised in handling them and they will be returned in the same condition as received. Kindly address photographs to—

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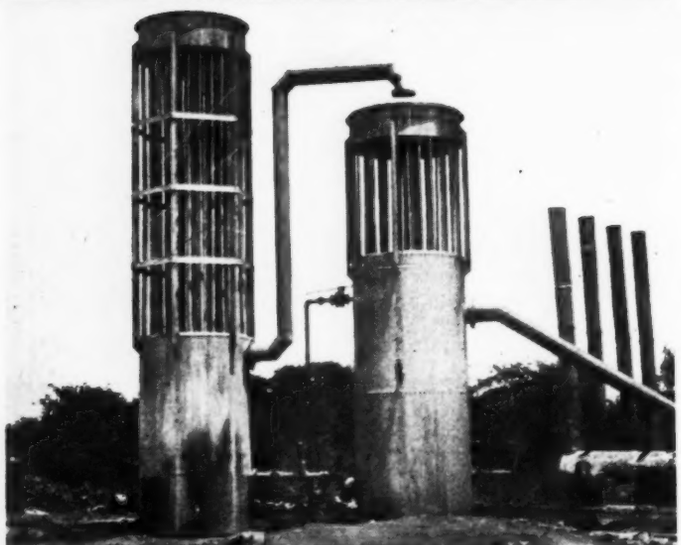
# Feed Water Heaters and Air Condensers on Drilling Wells

THE utilization of all the possible steam power on a drilling well has become quite an important problem since the advent of deeper drilling, with its heavier equipment and encounterance of greater pressures. The past several years have seen the application of several ideas and methods of obtaining greater steam power, without greatly increasing the amount of water consumed and increasing the boiler strain.

The latest appearance among equipment for this purpose has been that of feed water heaters and air condensers in the Oklahoma City field, where a number of drilling contractors have installations of this equipment. The equipment is so strange and different from the usual type of equipment found around a drilling well that any visitor to the field cannot help but discover its presence.



Above—Single type unit installation. Below—Double type unit installation.

These heaters and condensers are manufactured and designed to make use of the waste power coming from the exhaust of the rotary drilling engine, by heating and condensing and rerunning it to the boilers. Primarily the results are more steam with less boiler strain than under the regular boiler installation, and a drier steam, which is known to have more power than saturated steam.

A check-up on wells in the Oklahoma City field using these installations of heaters and condensers and those with the straight, regular type boiler hook-up has shown that the former have been able to make an average of about 11 feet more per day. The advantage of this can readily be seen when the producing horizon is 6500 feet deep.

The elimination of practically all boiler trouble is still another important feature. Boilers in the oil fields where the formations are deep, and the equipment consequently very heavy, have been under a heavy strain, due to no failure of the boiler manufacturer, since he could easily have increased the size and capacity, but was confronted with the problem of transportation if he did so. The preheating and condensing method makes the work on the boilers much lighter, while at the same time securing a better grade of steam for drilling purposes.

The fact that the feed water heater and condenser installation is making use of the power lost through the exhaust of the rotary drilling engine is a saving in itself.

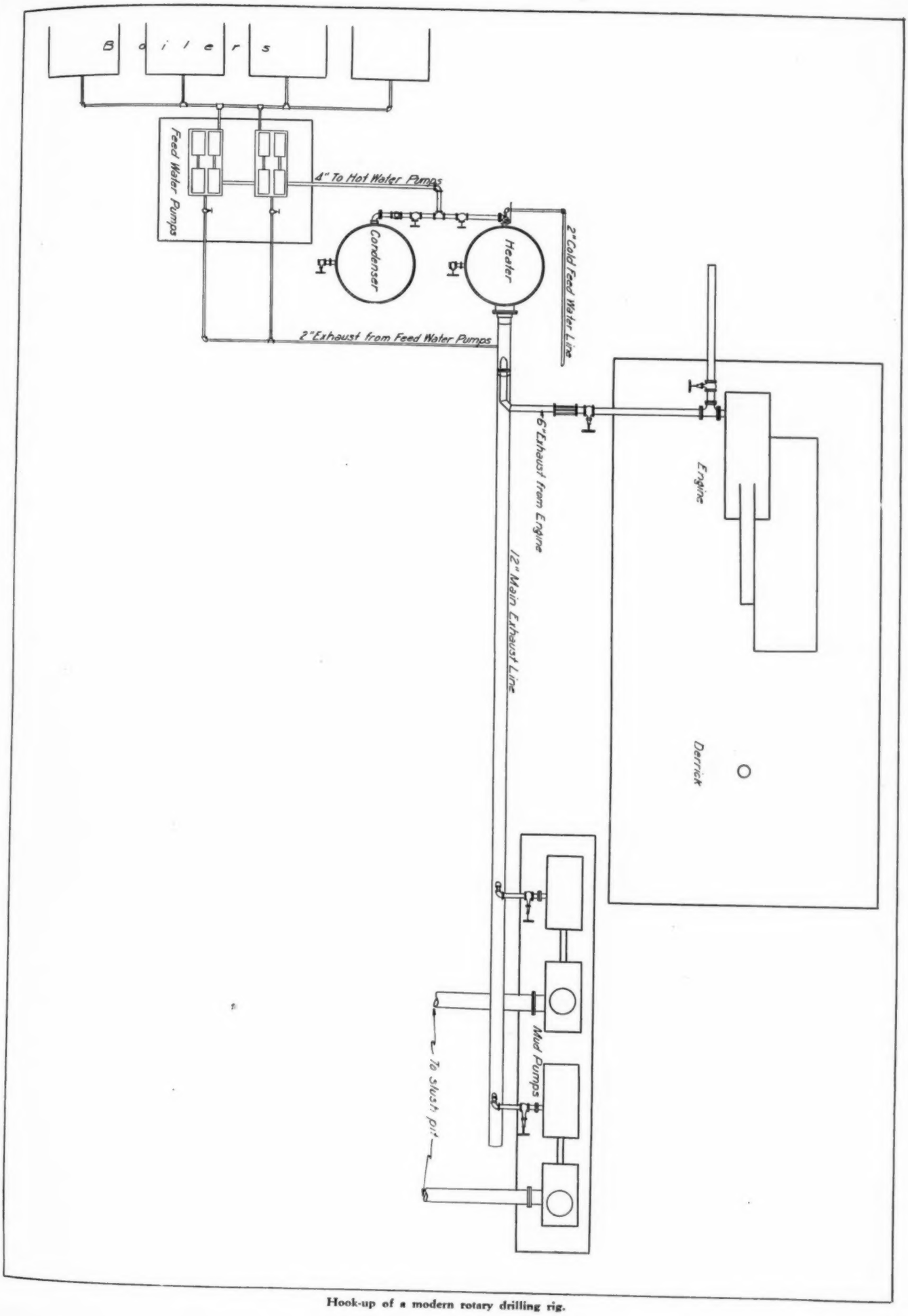
A graphic description of the installation is given in the accompanying drawing that should clearly show the hook-up and method of operating. These heaters and condensers are connected to the usual six-inch exhaust line from the power engine, thence by a four-inch line to the hot water pumps, thence to the boilers. This is not the size of all installations, but is taken as the average.

When the exhaust from the engine reaches the heater the first problem is to separate the oil and oily water from the clean exhaust secured. It is immediately heated for this purpose. The foreign matters settle out, after which the clean water obtained is trapped and placed back in the system.

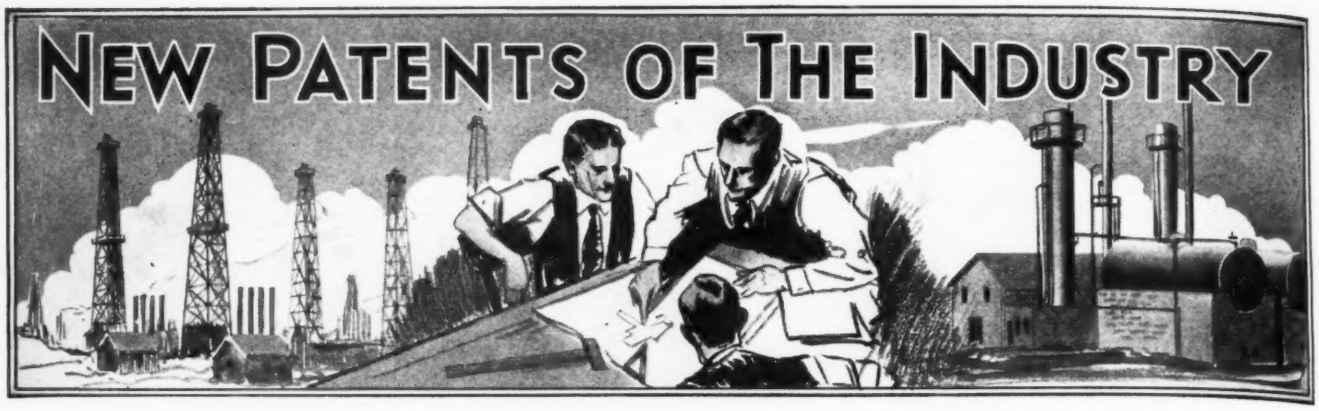
Steam from the exhaust pipe of the engine comes in contact with water in the condenser, causing the steam to condense, thus utilizing the saturation of the otherwise escaping steam for additional water. The condenser has two inlets for the water, an upper and lower inlet. The upper inlet is ordinarily used, but the lower is installed to take care of cases where sufficient water head is not available to force the water in against the steam.

It is said that approximately one pound of steam is condensed with every pound of make-up water taken in, and about eight gallons of water condensed per square foot during every 24 hours. An additional 10 per cent is caught on top of the equipment due to direct contact with air.

The usual installation at Oklahoma City is a double unit affair, but there are a few single units. The equipment is constructed so that in cases of lighter drilling that only one condensing tower need be used.

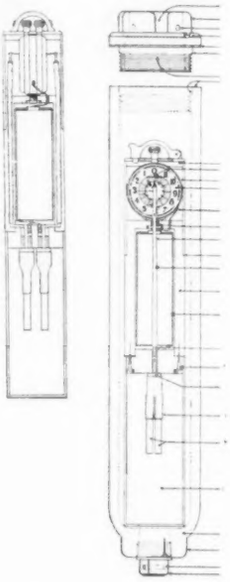


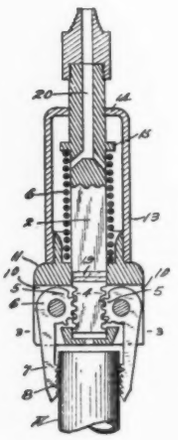

Hook-up of a modern rotary drilling rig.




1,764,222. WELL SHOOTING DEVICE. JESSE A. MORRISON, of Salt Creek, and EUGENE T. WILLIAMS, of Casper, Wyoming, assignors, by mesne assignments, to William J. Cheley (Zero Hour Torpedo Company) of Tulsa, Oklahoma. Patented June 17, 1930, United States Patent Office.

7. In a well shooting device, in combination, an exploding unit consisting of a shell of water tight construction, a time controlling means within said shell, and an initial exploder in said shell operable from said time conrolling means, together with a main exploder external to the shell and adapted to be exploded by the initial exploder within the shell.





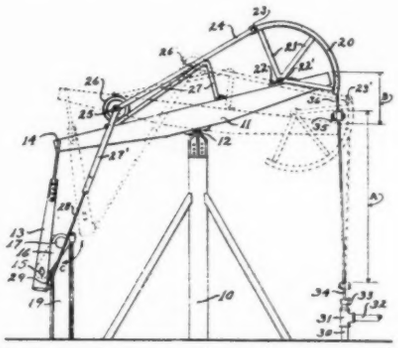
1,749,869. FISHING TOOL. ALBERT G. BAUMBACH, Anaheim, Calif. Filed Oct. 29, 1928. Serial No. 315,710. 3 Claims. (Cl. 294—106.)

1. A fishing tool including a stem having a rack portion, opposed gripping jaws meshing with the rack portion, and a mount in which the jaws are pivoted spring acting on the mount to close the jaws, and bolts in the mount to engage the stem.

1,764,068. STEEL SUCKER ROD AND THE LIKE AND ITS PRODUCTION. WELTON J. CROOK, Stanford University, Calif., assignor by mesne assignments, to Emsco Derrick & Equipment Company, Los Angeles, Calif., a Corporation of California. Filed Jan. 8, 1927. Serial No. 159,808. 6 Claims. (Cl. 148—2.)

3. The method of increasing the ultimate strength and resistance to fatigue and yet retaining the ductility of carbon steel sucker rods, the ends of which have been forged and machined to form pins by subjecting said rods, containing between 0.26% and 0.50% carbon and between 0.5% and 1% manganese, to heat at a temperature above the transformation point and for a sufficient period of time to bring about complete migration of carbon across the ferrite grains and then quenching the steel rapidly in suitable medium as a final step in the process.

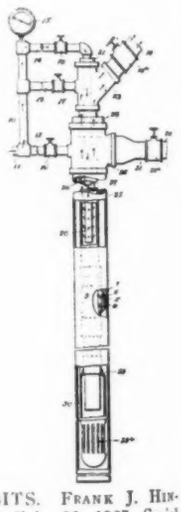
1,761,330. LONG STROKE PUMPING MECHANISM. JOHN U. DAVIS, Eldorado, Kans., assignor of one-half to Thomas E. Westbrook, Eldorado, Kans. Filed Jan. 2, 1930. Serial No. 417,987. 4 Claims. (Cl. 74—14.)



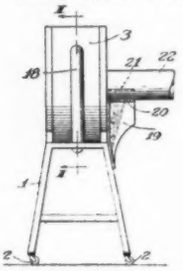
1. The combination of an oil well crank, pitman, walking beam, and Samson post, said walking beam being pivotally mounted on the Samson post, one end of said walking beam being connected to the said crank by means of said pitman, a curved sector pivotally mounted on the said walking beam and members to connect said curved sector to the pitman as an actuating means for said curved sector.

1,761,363. APPARATUS FOR AND METHOD OF FLOWING WELLS. HOLLIS P. PORTER, Tulsa, Okla., assignor to Gypsy Oil Company, Tulsa, Okla., a Corporation of Oklahoma. Filed Aug. 26, 1927. Serial No. 215,677. 16 Claims. (Cl. 103-233.)

1. In a well flowing apparatus, a casing having a tube extending down into the same, means for supplying an elastic working fluid to said tube at successively lower points in the well to flow liquid through said tube, means for rendering the first mentioned supply means inoperative, means for supplying said fluid to the casing at a point adjacent the lower end thereof to flow liquid through said casing, and a discharge connection for said tube and casing respectively.

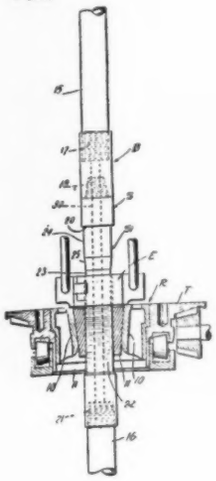


1,763,704. METHOD OF HEAT TREATING BITS. FRANK J. HINERDLITER, Tulsa, Okla. Original application filed Feb. 23, 1927, Serial No. 170,187. Divided and this application filed Mar. 21, 1929. Serial No. 348,696. 4 Claims. (Cl. 148—1.)



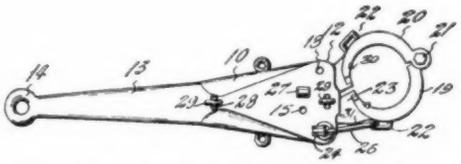
2. The method of heat treating the end of a bit and the like which consists in forming a substantially true ring of flame about and concentric with the nose end of the bit being treated but out of contact with the bit and creating a fire pocket adjacent the nose end of the bit so as to enable the same to be heated prior to the web portion of the bit, thereby causing a substantially even heating of the different portions at said nose end of the bit.

1,760,930 WELL-PIPE COUPLING. ELIHU C. WILSON, Los Angeles, Calif. Filed Feb. 12, 1923. Serial No. 618,694. 7 Claims. (Cl. 255—28.)



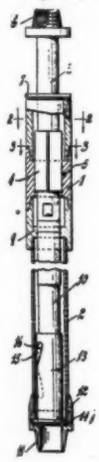
1. A well pipe coupling device, comprising two members having their upper and lower ends, respectively, adapted for connection with pipe lengths, and having at their other ends means to make a breakable joint between the two members, the lower one of the members having a relatively long and heavy shank between its two ends, said shank including a lower substantially cylindric zone engageable by supporting slips, and having, near its upper end, a downwardly facing elevator engageable shoulder, which shoulder is spaced by an elevator engageable zone above the slip engageable zone.

1,764,221. TONGS. THEODORE H. MILLS, Fresno, Calif., assignor of one-half to The Guiberson Corporation, Dallas, Tex., a Corporation of Delaware. Filed Dec. 12, 1927. Serial No. 239,294. 2 Claims. (Cl. 81—66.)



1. In a tongs, a head having a yoke formed with a pair of pivoting holes in parallel planes and a second pair of holes, one at each side of the pivoting holes and adjacent the edge of said yoke, gripping jaws connected at the outer ends by a fixed pivot and formed at their inner ends with outer bearing faces and pivoting holes, a pivot engageable with either pivot hole of the yoke and the pivot hole of one jaw, a closure pin disposed in one of the second pair of holes to engage the outer bearing face of the jaw which is not pivoted to the yoke and means connecting said closure pin with the jaw engaged thereby.

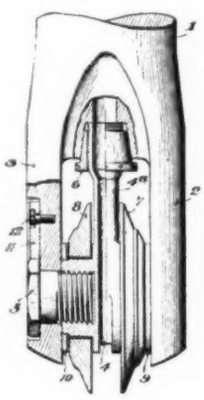
1,761,292. CORE BARREL. JOSEPH G. BONE, Long Beach, Calif. Filed Aug. 14, 1929. Serial No. 385,838. 7 Claims. (Cl. 255—72.)



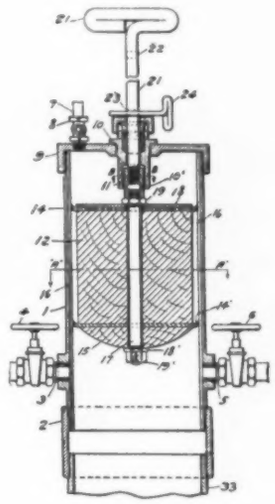
1. A core barrel comprising an outer barrel, an inner barrel within said outer barrel means slidably mounting said inner barrel, pipe coupling means on the top of said inner barrel, a sleeve rotatably mounted on said inner barrel, means coupling said sleeve and inner barrel whereby the sleeve is rotated as the inner barrel is raised or lowered, and means on said sleeve adapted to extend across the inner barrel when said inner barrel is raised.

1,764,432. WELL-BORING BIT. FRED L. BRONSON, Los Angeles, Calif. Filed Feb. 24, 1925. Serial No. 11,178. 1 Claim. (Cl. 255—71.)

A rotary disk bit comprising a tubular shank having a pair of legs projecting from the lower end thereof, a connecting member carried by said shank and disposed between said legs, said member being longitudinally adjustable with respect to said shank, said member also having offset laterally extending integrally formed tubular bearing arms extending to points adjacent said legs, bolts extending through each leg and threaded into said bearing arms, and a cutting disk mounted on each of said bearing surfaces.

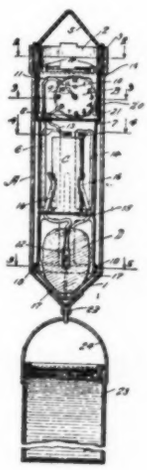


1,763,642. APPARATUS FOR CEMENTING WELLS. HORTON H. DIEVENDORFF, Santa Paula, and SIDNEY O. BARTON, Ventura, Calif., assignors to Pacific Oil Well Cementing Company, Incorporated, Los Angeles, Calif., a Corporation of California. Filed June 6, 1928. Serial No. 283,352. 5 Claims. (Cl. 166—1.)



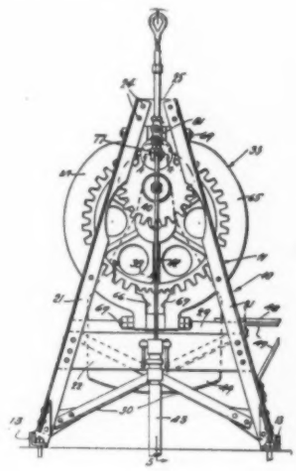
1. A well cementing apparatus, comprising, a capped metal casing head with grooved passageways extending longitudinally along the inside wall of the casing head, means for attaching the casing head to a well casing, a mechanically controlled slidable plug in said casing head and controlled inlet means into the casing head.

1,764,222. WELL-SHOOTING DEVICE. JESSE A. MORRISON, Salt Creek, and EUGENE T. WILLIAMS, Casper, Wyo., assignors, by mesne assignments, to William J. Cheley, Tulsa, Okla. Filed Sept. 15, 1923. Serial No. 662,963. 12 Claims. (Cl. 102—4.)



6. In a well shooting device, in combination an exploding unit comprising a casing having a self-contained time controlling means, and an associated initial exploder, said unit being water tight and adapted to be pre-set in relation to the time controlling unit to set off the initial exploder whenever desired, and a main sand-shattering exploder external to said shell and its self-contained features, and adapted to be operated by the explosion of the initial exploder within the shell.

1,764,058. PUMP JACK. EDWARD E. STEVENSON, Los Angeles, Calif., assignor, by mesne assignments, to Emsco Derrick & Equipment Company, Los Angeles, Calif., a Corporation of California. Filed June 8, 1927. Serial No. 197,364. 3 Claims. (Cl. 74—14.)



1. In a device of the character described, a supporting member, a pair of complementary segment-racks secured to the supporting member in complementary arrangement to form an internal gear and having their opposed ends spaced apart to provide tooth spaces of greater extent than the tooth spaces of the racks, and a spur pinion adapted to mesh with a travel about said gear and having an enlarged tooth adapted to enter said larger tooth spaces.

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